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ELECTRICAL REVIEW

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THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. XVIII.—No. 448.

EXTRACTING METAL BY ELECTRICITY.

IN another column will be found a communication which has been forwarded to us for publication in reference to the proposed operations of a company formed for the purpose of working on an extended scale upon the extraction of the pure metal from waste tin cuttings. If a method has really been devised by which this object can be thoroughly effected, there is an enormous source of profit open to the promoters of the scheme. But we cannot let the matter go before our readers without relating a little of our own experience in this direction.

Some eight or ten years ago, for a period of several months, we assisted in extensive operations for recovering the tin from waste tin cuttings by means of electricity. These experiments were conducted near the Caledonian Road, quite close to King's Cross, and many tons of waste metal were operated upon. The plant consisted of two large tanks of rectangular shape, about 6 feet by 4 feet, with a depth of 16 feet. Pulleys or rollers were placed at each end, top and bottom, and over these passed endless chains. At a distance of two feet or so apart, brass rods were attached to these chains, and on the rods was slung the scrap tin plate from which it was desired to extract the tin in the form of black oxide, leaving the iron clean. A continuous series of rods containing scrap tin plate was therefore passing into and out of the bath until the tin had been cleared off. Each rod was then emptied of its load and a fresh supply put on. The dynamos employed were of the old Gramme electro-plating type, and were three in number. They were used singly, by twos, in series and parallel, and by threes in the same manner. For a time the operations would go smoothly enough, and then a complete change occurred, and the result was anything but satisfactory. The solution of the bath, having to be kept at a moderately high temperature, gave off fumes which oxidised the rods upon which the scrap tin plate was hung, and they were perpetually being cleaned. Many were the suggestions made and devices employed to eliminate bad contacts, but without avail, and after many months of hard work, and the expenditure of much money, the attempt was abandoned as a failure.

It must not be supposed, however, that no satisfactory results were ever obtained. Several tons of metal were actually thrown out, the surface of which was completely denuded of tin. Great efforts were made to get rid of the iron, which was of course of most excellent quality, but in no instance do we remember a purchase being made; in fact, iron founders refused to use it at any price, asserting that the metal was still impregnated with tin and that it could only be rendered perfectly free by furnace heating. The cost of working far exceeded the value of the products obtained; and thus ended an enterprise which was pluckily sustained for a considerable time in the hope that obstacles apparently insurmountable would be overcome.

The projected operations of the Electro Metal Extracting Company appear to us to be of precisely the same character as those which we witnessed and assisted in. It is possible that the difficulties which existed ten years ago have been again encountered, and this time surmounted. We have simply related our own experience for what it may be worth. We have not yet had the opportunity of inspecting the plant of the company, and therefore cannot say in what details it differs from that before described. We are not imbued with the enthusiasm with which possibly a direct interest in the concern has inspired our contributor; but, in justice to a new project which, on the face of it does not necessarily appear doomed to failure, we must reserve our judgment until data be forthcoming which will enable us to give a definite opinion on its prospects. That an undertaking of the kind may be practically carried out with success we do not doubt, but it remains to be seen at what cost. It is easy to estimate upon paper the working cost and the profits which will accrue to the shareholders in such a concern: calculations upon a theoretical basis declared that the unfortunate undertaking of which we have already spoken was a splendid thing for those who chose to invest, but in actual working on a moderately large scale it was quite different. "Samples" are to be seen at the company's office; but this fact of itself does not possess much value as a proof of the genuineness of the undertaking. We shall be glad to learn that the company's operations are proving successful, for the amount of work waiting to be done in this field is astonishingly great.

Since writing the above remarks we have received samples showing waste tin cutting before and after treatment, and also samples of the pure tin extracts, the analysis of which is said to show 99·2 per cent. These extracts are of a bright colour and have somewhat the appearance of tin amalgam: we should like to know whether they are deposited in this form, or are obtained from the oxide.

AN ELECTRIC LIGHT FIRE-DAMP INDICATOR.

THE Royal Commission on Accidents in Mines * points out in its recently issued report a serious objection to the use of the electric light in mines, notwithstanding its many other great advantages, in that the light of an incandescent lamp being produced within a vacuum cannot admit of any device for the indication of fire-damp, such as is employed in the Davy for example. This difficulty was experienced by one of the inventors of the apparatus we are about to describe in the course

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* See ELECTRICAL REVIEW April 16th, 1886, p. 341.

of an installation of the electric light in the Lofthouse pit, Wyke, Yorks, in the summer of 1885, and a series of experiments have since been carried out with the object of devising a method of making the electric light an indicator of fire-damp.

The apparatus placed before the Physical Society at the meeting of Saturday the 12th inst., is the outcome of the work of Messrs. Walter Emmott and William Ackroyd. It consists of two incandescent lamps, one with white glass and the other with red, and other necessary adjuncts, such that in an ordinary atmosphere the white incandescent lamp alone shines, but in fire-damp the white lamp goes out and the red one begins to emit its light. This is effected as follows :—A porous pot of unglazed hard baked porcelain is joined by air-tight connections to a tube, a portion of which is represented by T, T^1, fig. 1. This tube is of such an internal diameter that it will readily admit of being sealed with a small quantity of mercury, Hg. A platinum wire runs the whole length of the tube, and is connected with one of the poles of the battery, B, or other source of electricity. Two other platinum wires in the tube run parallel with this for part of the way, as in fig. 1, and each is connected with a lamp. The lamps, W and R are joined and a branch wire connects them to the other pole of the battery. In fig. 1 the current is represented as flowing through W; when from diffusion in an atmosphere of fire-damp, the conducting plug, Hg, is driven up to T^1 the current will flow through R, and the red light may then be taken to indicate the presence of fire-damp. The wires being within the tube one or other of the lamps must always be shining so long as there is a current, whether the apparatus be in an atmosphere of fire-damp, choke-damp, or air; and to prevent the mercury being driven out of the tube by too much pressure, bulbs are arranged on either side, as in fig. 2, which presents a diagrammatic view of the apparatus.

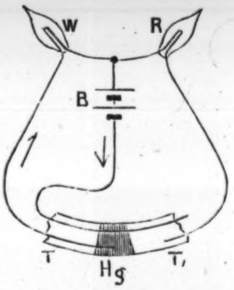


FIG. 1.

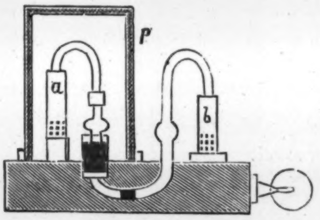


FIG. 2.—*p*, POROUS POT; *a*, *b*, DESSICATORS.

The inventors find an internal diameter of tubing of about 3 mm. best adapted for ensuring easy mobility of the mercury. The presence of the wires within the tube has interfered with the perfection of the seal; this, however, has been overcome by the introduction of a little concentrated sulphuric acid, which also serves the purpose of preventing sparking and of lubricating the interior. The use of sulphuric acid necessitates the addition of dessicators, *a* and *b* (fig. 2), to each end of the tube, but in cases where it has been found advisable not to use sulphuric acid both the acid and the dessicators have been dispensed with by slightly modifying the arrangement of the wires at the lower part of the tube.

With this form of apparatus one can readily detect the presence of 5 per cent. of coal gas in a mixture of this gas with air, and with a mercury seal of less weight and closer proximity of the wires at T and T^1 (fig. 1), it appears possible to get any required degree of sensitiveness.

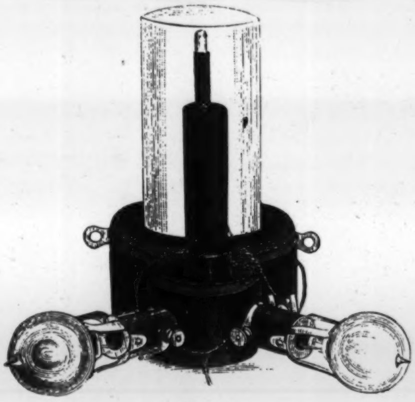


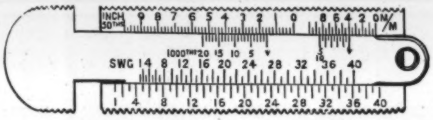
FIG. 3.

Fig. 3 is a view of the apparatus about one-third full size.

STANDARD WIRE GAUGES.

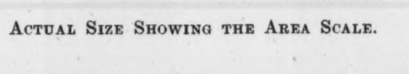
IN February of last year we brought under the notice of our readers a new wire gauge, based on the English standard sizes as fixed by the Act of 1883, and we revert to it again in order to mention several valuable improvements which have been effected in it and which render it of much greater value to electricians.

In its improved form the gauge will register the legal number of any wire between No. 1 and No. 40, S.W.G. (standard wire gauge), formerly it only read up to No. 6.



ACTUAL SIZE SHOWING S.W.G. INCH AND MM. SCALES.

In addition to this very valuable extension the area scale by which the current suitable for any size of copper wire can be calculated has been enlarged, and, whereas it only registered the area in thousandths of a square inch up to ·030 square inch it now gives them up to ·070 of a square inch. We illustrate this scale of areas and draw special attention to it on account of its usefulness for calculation.



ACTUAL SIZE SHOWING THE AREA SCALE.

In the first place, if the current be taken as 1,000 ampères to a square inch of copper, then this scale of areas may be taken as a scale of ampères direct, but if it be decided to transmit at the rate of 2,000 ampères to the square inch, then all that is necessary is to multiply the area by 2. Again, if the area figures be multiplied by 0·4 (more accurately 0·0386) it will give the weight in lbs. per 100 feet of the wire measured, while by multiplying the area by 12 we have the length in feet of copper wire having a resistance of one tenth of an ohm. By multiplying the area figures by 0·323 we get Sir William Thomson's rule of 0·5 ampère to a square millimetre. Again, multiplying by 0·0575 we get horse-power lost per mile with 1,000 ampères to the square inch. 42·8 divided by the area gives the resistances in ohms per mile, while the area multiplied by 20·35 = lbs. per mile. In use all that it is necessary to bear in mind is, that when any two numbers of the same name *coincide* these indicate the reading. Our illustrations will show what we mean; the S.W.G. numbers most nearly coinciding are 8, while on the area scale neither 18 nor 20 are quite opposite; the area of the wire supposed to have been measured is ·019 square inch. Very little practice will suffice to make its method of working clear.

A spring has been added in order to keep it steady when once fixed, and also to prevent its working loose.

These considerations seem to point to this little instrument as one likely to supply a want of electricians generally, as anything that saves time and facilitates prompt and accurate calculations cannot be other than of the utmost value in these days of high pressure. We cannot but compliment the inventor, Mr. A. P. Trotter, as the gauge is both novel and useful. It has been brought out by Messrs. Walter T. Glover & Co.

ELECTRICITY AND MANUFACTURES.

[A COMMUNICATION.]

HE would indeed have been considered a very bold man or a fanatic who but five or six years ago had expressed an opinion as to the future position of electricity, as relating to its actual attainments as exemplified in the year of grace 1886. But in this as in most other matters there is more surprise in practice than in theory. The electric light is now carried into the workshops of our land, and by its aid no skulking is possible, as it shows up all the dark corners, and also enables night to be changed into day, thus causing colours to be manufactured with ease, and giving the operatives of our factories a far healthier atmosphere to breathe.

Electricity also adds to our comforts in various ways, and few, if any, having once experienced its advantages are willing to set it aside. Its development has also occurred at a period in our national history when our manufactures had sunk to a low ebb, until it has opened up a source of employment for capital and labour, which is increasing and is destined to become of considerable magnitude. There are really few persons, even of those classes who should have known better, who are acquainted with the present position of electricity in Great Britain; fewer still know anything of what it is accomplishing abroad. Everyone knows it is used for lighting purposes and for electroplating, and in some few instances for the purpose of propulsion; but for other purposes their knowledge is exceedingly limited. The adaptation of electricity to the requirements of mankind would amply repay an investigation, but this is too large an undertaking for our limited space, although we may very probably refer to this in some future article.

The refining of copper in Great Britain has within the last few years created quite a new industry which is being rapidly developed; the electric current is also applied for making ozone, for bleaching and dyeing purposes, for refining sugar, for removing and preventing scale in boilers, and for refining oils, for encouraging vegetable growth, for all the ills and ailments of mankind, and a variety of other purposes; also for electrotyping purposes, rendering it possible to lay on any metallic surface upon drawing room furniture or delicate lace and ferns, as well as for the deposition of copper upon hydraulic rams, screw propellers, &c. These are what we may see any day in our own works. In America there is a yet wider application—it is employed there to catch thieves, to kill animals for food, or animals which are vermin, also for tanning purposes, and in the skinning of animals without injury to the hides, but the most recent application there is the production of alumina by its agency.

Having mentioned a wide field of operations we have now under our notice a further extension. The Electro Metal Extracting, Refining, and Plating Company, Limited, of Finsbury Chambers, 76, Finsbury Pavement, London, E.C., is formed with a capital of £50,000, in £1 shares, to extract and recover the tin from waste tin cuttings, of which electro process the company has acquired the sole rights and monopoly. The company is going to lay down plant in London (now being proceeded with), Wolverhampton, Birmingham, Swansea, Truro, Liverpool, and Glasgow, capable of dealing with a minimum quantity of 10,000 tons per year, or not one-third of the total available quantity of waste tin cuttings, which as waste material can be had for from 2s. to 5s. per ton delivered at the company's works. It seems that by the company's electro process every 20 tons of waste tin cuttings treated yield one ton of pure tin (chemically pure), worth £95 to £100 per ton, and when the cuttings are thus stripped of the tin there remain 19 tons of black charcoal iron scrap, worth 40s per ton more, or say £38—in all £133, from every 20 tons of tin cuttings. The company allows £54 for the cost of tin cuttings and the whole cost of working operations upon the quantity, which leaves a net profit of £79 for every 20 tons waste tin cuttings. It is not necessary to show how very profitable such working would be for even 10,000 tons.

The electro process of this company is as follows:—Powerful dynamos of approved make, giving suitable E.M.F., generate the requisite current, which is passed through a series of 20 baths containing suitable solutions, and the waste tin cuttings are placed therein and connected to the positive pole of the dynamo; suitable arrangements are made for "receiving" the valuable metal (tin), and after being washed this is further refined and made ready for the market, where it commands the highest price (£100 per ton).

The company is also laying down plant for galvanising iron goods by their electro process, the sole rights and monopolies of which it has also acquired. The advantages of this electro zinc process are, not an ounce of metal is wasted, no heat is applied, the deposit of zinc can be regulated to any desired thickness, and the fibre or tensile strength of the article galvanised is not affected, no acid being used, whilst the cost of the process effects, it is claimed, a saving of 30s. per ton of iron goods "galvanised," and it leaves a smooth surface—not lumpy and irregular. The company proposes to treat 20,000 tons of iron goods per year, and will grant licenses to the galvanising trade.

The electro process herein referred to enables the company to treat the immense quantities of mining tailings, mining refuse, and slag, which lie accumulated in heaps of hundreds of thousands of tons on the banks of disused mines as well as working mines, and to recover from such gold, silver, copper, and tin. This alone is an enterprise worthy of attention, as the "waste stuff" when worked by the primitive appliances of former days was incapable of being treated, although known to be rich in these valuable metals. It is probable, therefore, we may witness a resuscitation of "disused" mines, and great activity amongst those now paying no dividend. The treatment of refractory ores by the electro process of this company is also within its objects, and thus it brings before its shareholders a most extensive field of operations.

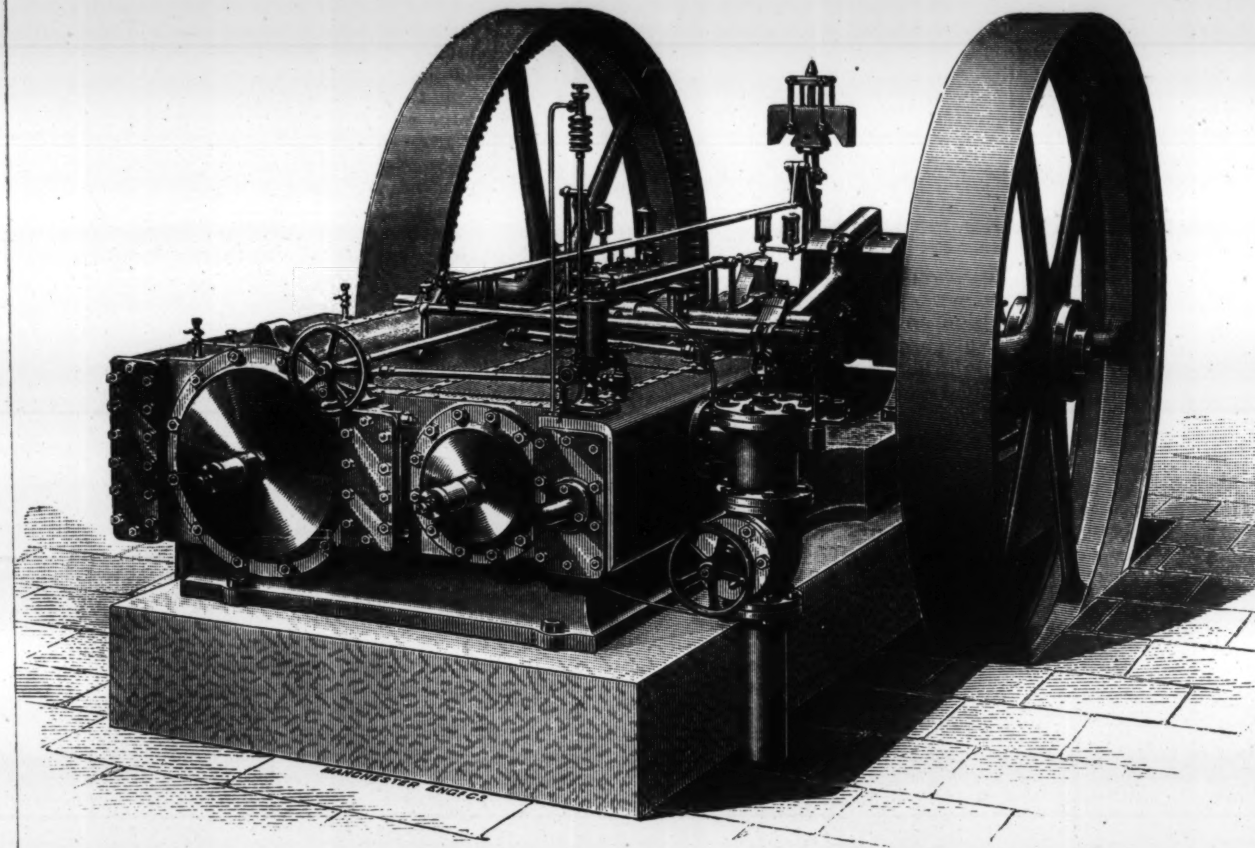
Samples of waste tin cuttings before and after treatment, and showing the tin recovered, can be seen at the company's offices in London as above named.

Enough has been said by us in this article to show that electricity in our manufactures is extending, and that it is destined to become an important factor in British industries.

[Some remarks anent the particular use of electricity dealt with in this article may be found in our leading columns.—EDS. ELEC. REV.]

ELECTRIC LIGHTING AT THE COLONIAL AND INDIAN EXHIBITION.

THE explanation of the broad distinction which is observable between the electric lighting arrangements of the Inventions Exhibition and those of the present one, is to be found in the fact that while the whole of the machinery and apparatus last year were exhibits, this year the matter has been dealt with as an accessory on the same footing as the music and similar attractions. There is not to be found, therefore, in the present exhibition a large number of different systems competing, but the Executive Committee has made arrangements with certain firms to supply the necessary plant for the lighting of the buildings and grounds. As to the buildings, the work has been pretty evenly divided between the following four companies : the Anglo-American Brush Corporation, Messrs. R. E. Crompton & Co., the Edison and Swan United Company, and the Pilsen-Joel Company. The machines for these services are in the old electric light shed, and are all driven by the engines supplied by Messrs. Davey, Paxman & Co. In the illumination of the grounds and fountains a complete change has been made, and this work, which last year was performed by Messrs. Siemens, is now allotted to Messrs. W. and J. Galloway, of Manchester, whose engines and boilers have been familiar objects in former exhibitions, but who now for the first time make their appearance as electric light contractors. In the first place this firm took over the whole of the plant which was in use for this purpose last year, and the three Siemens dynamos and three Goodfellow and Matthews high speed engines occupy their old place in the Western Quadrant near the Conservatory standing idle, though ready for use in case of an emergency. Adjoining the disused machinery Messrs. Galloway have erected one of their patent high-pressure, non-condensing, twin-compound engines, which drives two dynamos, one a Victoria F 3, supplying 16 arc lights in use under the fountains, and the other a 20-light Brush machine supplying current to the 18 arc lights on the two 80 feet high masts and on the mast above the clock. Two engines of similar construction are placed in a building adjoining the Canadian Machinery Court each driving two Elwell-Parker 4-pole 50-unit horizontal dynamos. These provide the current for all the small glow lamps about the gardens and exterior of the buildings, about 11,000 in number, nearly all of which are of 5 C.P. We have been favoured by Messrs. Galloway with the following description of their engines.



The engines are of the Woolf type, that is to say, the cranks are placed opposite one another, or at an angle of 180°, so that the steam exhausts directly out of the high-pressure cylinder, 15 inches in diameter, into the low-pressure cylinder, 26 inches diameter, the stroke being 2 feet 6 inches. The engines are, consequently perfectly balanced both for reciprocating and rotary weights. The cranks are slotted out of the solid, and the shaft is 8½ inches in diameter, in order that great stiffness may be secured. The bed plate is cast in one piece, and there are two overhung fly-wheels, one on each side, 10 feet in diameter and 16 inches wide on the face, so that the engine is perfectly symmetrical. The crank-shaft is probably the heaviest that has been used for an engine of the given dimensions, making 100 revolutions per minute with a steam pressure of 75 lbs. The crank shaft brasses are in four pieces, adjustable with wedges and screws. They were very carefully fitted in the plummer blocks, jammed tight and bored out in place at one operation, and then parted by a special tool. The slide valves are flat plates about 1½ inch thick, six in number—that is to say, two admission valves for the high-pressure cylinder, two intermediate valves, which are at the same time exhaust valves for the high and admission valves for the low-pressure cylinder, and two exhaust valves for the low-pressure cylinder. The exhaust steam is conveyed under the floor to a cast iron box, 4 feet square, where it parts with much of its water, and thence passes up the brick chimney of the three Galloway boilers which supply steam. These, with a fourth or spare boiler, are the same boilers that were in use last year. The valves are driven by two excentrics. One of these is of cast iron for the low pressure slides; the other is of wrought iron turned out of the solid in the centre of the shaft, and it drives a rocking expansion link of the kind regularly used by Messrs. Galloway, and the high pressure admission slides. The expansion gear is not automatic. The grade of expansion can be regulated in a moment with the greatest nicety by hand, by means of the wheel seen at the back of the engine, which works a screw traversing the die in the expansion block. The governor is of Messrs. Galloway's well-known parabolic type. It is driven by grooved friction wheels and mitre gear, and operates a double-beat throttle valve in the vertical branch of the steam pipe. A coiled spring is so arranged round the weight shaft that its tension can be altered at pleasure, which has the same effect as increasing or diminishing the dead weight on the governor; and in this way the speed of the engine may be varied within wide limits without trouble, which is not always the case when the action of the expansion gear controlled by the governor is automatic. Thus, for example, it was intended to run the engines at 90 revolutions, but as rather more work was required from the dynamos than was anticipated, the engines have been speeded up to 100 revolutions.

The lubricating arrangements have been specially devised to overcome all difficulties. The crank-shaft has holes bored down each end, then along the outer crank web and then through the crank-pin; openings are made from this latter hole to the surface of the pin. The outer ends of the holes in the crank web are subsequently stopped by screws. Thus, passages exist from the ends of the crank-shaft to the crank-pins. A sight-feed lubricator is fitted to each end of the crank-shaft, and the centrifugal force is found much more than sufficient to draw in the oil and so lubricate the big ends in the most perfect manner. Sight-feed lubricators are fitted to every bearing, even to the cast iron excentric, which has a long groove or cell cut in the top of the hoop, into which the oil drops, no matter at what part of its throw it may be.

With reference to these engines, the following criticisms are passed by Messrs. J. & H. Gwynne in a letter published in last week's *Engineer*:—

"We take the present opportunity to say a few words about the governing of electric light engines. We quite appreciate the advantage of steady running for all kinds of work, but much nonsense has been spoken and written about defects in lighting due to imperfect governing in steam engines. We are at a loss to know what our electrical friends would have done a few years ago had the steam engine, and more particularly the unfortunate governor, not been at hand to answer for their sins of omission and commission, and to cover their inexperience. It is a fact that an engine driving a dynamo with a crowd of incandescent lamps properly fixed requires a governor just as much as one of our pumping engines when working under a constant head, that is, not at all till something goes wrong, or a big change takes place in the number of lamps on circuit. The dynamo governs the engine to perfection, just as the head governs the revolutions of the pump. Many marine engineers do not use the governors provided with our engines for ship lighting. With regard to arc lamps, one need only stand for a few minutes in a public place to see that the carbon-feeding mechanism wants a governor very badly, and that irregularities in lighting due to imperfections in lamps are greater by a hundred per cent. than could be caused by the worst-regulated engine ever put down to drive a dynamo.

"We cannot admit that mill engines give less trouble than good engines used in other branches of industry. The carefully-compiled analysis of breakdowns published by Mr. Michael Longridge, of the Engine and Boiler Insurance Company, every year, gives most instructive evidence on this point, as we presume that most of the engines which fail belong to mills in Lancashire and Yorkshire. Among mill owners, as among other steam users, there are some men far-seeing enough to look beyond the mere first cost of their machinery. Such men go to builders of high reputation and great experience, pay a good price, and secure engines which give them no trouble. The skill and experience necessary to produce good engines for electric lighting are not now lacking, and if buyers will allow for a margin of power beyond their probable or calculated requirements, prepare themselves to pay a good price, then go to an engineer who has a reputation to lose, not to an engine maker, and leave all details in his hands, they will be provided with engines which will run as well as the best mill engines ever produced.

"Outside of defects in the electrical department, the causes of engine failures have been obvious enough. The chief of these is over-driving; cheap and badly-designed engines put down too small, and driven at a pace which kills them; well-designed and well-made engines put down too small, because the power is under-estimated, and driven at speeds which scientific investigation shows to be injudiciously high for smooth and permanent working. It must not be inferred from the foregoing statements that there is any difficulty in making an engine run at very high speed with perfect safety; we merely mean that there is a speed for every engine, beyond which it may not be driven with impunity. We have engines with 10 inch cylinders running beautifully all day long, fully loaded, at 450 revolutions per minute, simply because they are specially designed to run properly up to this speed. Were we to put another 150 revolutions to the speed, all the conditions would be altered, and very likely trouble would arise sooner or later.

"We are glad to be able to acknowledge that during the past two years electricians have shown great readiness to reduce the speeds of dynamos, so that direct driving can be satisfactorily resorted to in the multitude of cases in which installations such as Messrs. Galloway's would be quite inadmissible, owing to want of space."

The fountains of the Indian and Colonial Exhibition are illuminated from underneath by nine large hand-fed arc lamps, specially designed and made by the Woodhouse and Rawson Electric Manufacturing Company, Limited. The carbon holders are mounted on insulating blocks attached to saddles, which slide on two brass tubes fixed to end brackets, the whole being supported at about 20° angle with the horizontal base plate. The feed is effected by a screw passing through the saddles between the tubular guides, one end of which has a right hand thread, and the other a left hand thread of double the pitch. This screw is carried through one end bracket in a tapped bush which is partly split, and can be clamped on the screw by a nut running on an outside taper thread. When this is so clamped, the turning of the screw hand-wheel simply gives the necessary feeding motion, one carbon moving at twice the rate of the other; but if the tapped bush is unclamped, and turned on the screw by a hand-wheel attached to it, the screw and carbon holders are shifted bodily longitudinally, thus giving a horizontal adjustment of the position of the arc. To give a universal adjustment of the position of the carbon points with regard to each other, one of the carbon holders consists of a bracket carrying a cylinder fixed horizontally and at right angles to the screw; on this cylinder is a sleeve carrying the carbon holder proper, which can be moved horizontally or turned on it in a vertical plane, thus giving a perfect adjustment of the points; this sleeve is moved and clamped in position by an insulated handle which acts as a set screw.

Messrs. John White and Sons, of the Park Road Leather Works, Bingley, Yorkshire, who supplied the leather belting for driving the machinery in the electric light department of the International Inventions Exhibition of 1885, have been retained in the same department for the Colonial and Indian Exhibition of this year. The following particulars relating to a portion of the main belts of 1885 may be of interest, showing such combined results in belt driving as have probably never been previously attained :—

No.	Length.	Width.	Speed.	Transmitted.
No. 1	—70 ft.	× 10 in.	... 2,585 ft. per min.	... 120 I.H.P.
„ 2	—73 „	× 15 „	... „ „ „	... 170 „
„ 3	—60 „	× 16 „	... 3,270 „ „	... 200 „
„ 4	—86 „	× 24 „	... 2,585 „ „	... 350 „
„ 5	—„ „	× 15 „	... „ „ „	... 170 „
„ 6	—„ „	× „ „	... „ „ „	... 170 „
			Total ...	1,180 „

THE ROYAL HOLLOWAY COLLEGE.

ON Saturday last, at the invitation of Mr. G. Martin-Holloway, a large company of gentlemen inspected the splendid pile which has been built at Mount Lee, Egham, for the purpose of a ladies' college, and which owes its existence to the philanthropy of the late Mr. Thomas Holloway, who during his lifetime provided and dedicated the necessary funds for its erection and endowment. In every respect the liberal intentions of the founder have been carried out by the trustees in a thorough and even lavish manner, with the result that the site, the buildings, and the fitting up and furnishing are everything that could be desired. The work is now aptly brought to a conclusion by recognition on the part of the highest lady in the land which, it is said, has never before been accorded to any similar institution. The privilege of using the prefix "Royal" has been granted in other cases, but only after the ceremony of opening has been performed by a member of the royal family ; but in this instance Her Majesty has already voluntarily commanded that the institution shall be henceforth called the Royal Holloway College, and has also expressed her willingness to perform the public opening ceremonial on the 30th. The electric lighting of the college buildings was entrusted only a very few weeks ago to Messrs. B. Verity and Sons, of King Street, Covent Garden, who in the short space of time allowed them have produced some specimens of artistic brasswork of a most elaborate character from special designs, some of which were supplied by the architect, Mr. Crossland. Through the library and museum there are 16 massive Renaissance brass standards raised on marble blocks, each supporting six branches terminating with glass shades, covering 32 C.P. lamps. The recreation hall, which contains a choice selection of paintings brought together by Mr. Martin-Holloway at an outlay of over £80,000, is beautifully lighted by electroliers. In the dining hall a different plan is adopted, the lamps being in twelve groups close to the ceiling, each group of six lamps being under a green reflector. Some brackets of exquisite design add to the splendour of the chapel, the roof of which is decorated with coloured figure subjects in high relief, the principal one being, very aptly, the creation of Eve. At present only the ground floor is fitted up for lighting, the total number of lamps being 600, but it is expected that ultimately it will be extended to the whole building, when the installation will form one of the largest in existence. The lamps are all Edison-Swan of 16 and 32 C.P., and the two dynamos are Edison-Hopkinson 400-ampère machines. These are driven by a Davey, Paxman and Company's horizontal compound engine. The system of small circuits is adopted, none exceeding 25 ampères, and the switches and cut-outs are all double-pole and made substantially on slate. For the machinery a special building has been put up of a most substantial character, and with every convenience, nearly a quarter of a mile from the college buildings, nearer Egham. At the same spot all the household supplies and stores will be received, and for the despatch of these to the main building a tunnel has been made and rails laid. The trucks on this miniature railway will no doubt be worked by an electric motor, though we are not aware that this is actually decided upon.

THE UPWARD PRIMARY BATTERY.

WE give this week a more detailed account of the Upward battery, as promised in our last issue.

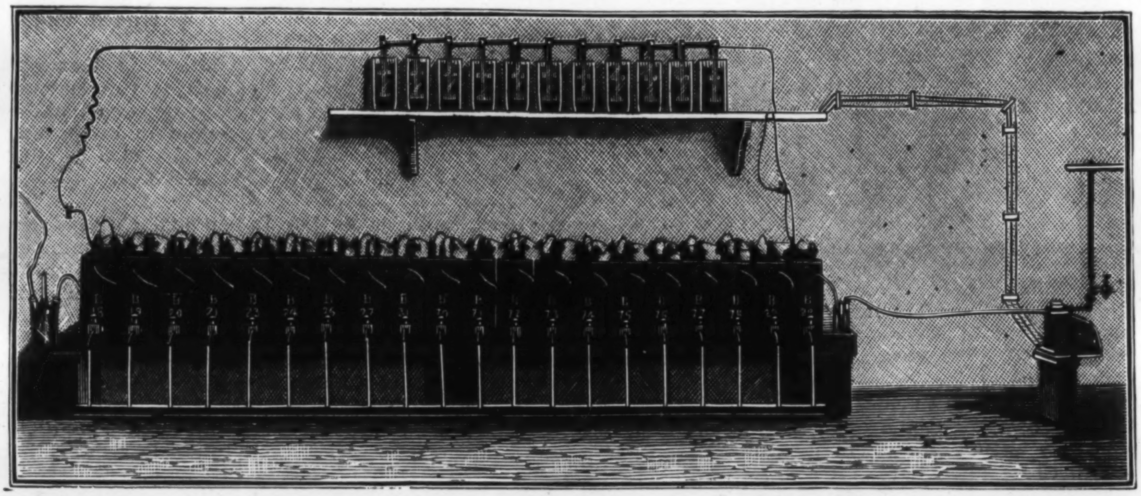


FIG. 1.

Fig. 1 is engraved from a photo. of a battery of 20 cells, which has been at work for the last six months in the works of the Woodhouse and Rawson Electric Manufacturing Company, and which requires absolutely no attention whatever, except the weekly addition of water to the zinc cells to make up for what has percolated through the porous pots into the outer cells. The zinc plates were all replaced about a month ago. They had by constant use been reduced to the thinness of a wafer, and the renewal only occupied one man between 30 and 40 minutes.

This illustration and figs. 2 and 3, which are a section and side elevation of a single cell, will make our last week's description quite clear ; A is the outside glazed earthenware cell ; B, the porous pot, C, C, the two carbon plates, surrounded by crushed gas retort carbon, and sealed with cement at H ; Z, the zinc plate ; D, the gas inlet to outer cell ; E, the gas outlet ; T, earthenware tap, connected to a glass tube, F, which dips in the trough, G. The trough is constantly full of zinc chloride, which has drained out of the carbon cells. The dimensions of these particular cells are 11½ inches × 5½ inches and 12½ inches deep.

The zinc chloride solution which is formed by the working of the battery, very slowly percolates through the porous pot, B, into the outer cell, and insures the broken carbon remaining moist; but the tap, T, which is always open, prevents any liquid accumulating in the outer cell; allowing it to run down F into the trough below. The level of the liquid in this is always kept above the orifice of the tubes, so that no gas escapes, while an overflow is provided into the house drain. ($ZnCl_2$ is an excellent disinfectant.) The method of supplying the cells with chlorine gas is highly ingenious. The gas arrives from the holders (of which more hereafter), by the tube seen at the left of fig. 1, where it passes into a bubbling bottle, from which it enters the lower part of the first cell (B 18); the exit at the upper part of this cell is connected by a tube to the inlet at the lower part of the second cell, and so on through all the cells in series; the exit of the last cell being connected by a tube, through another bubbling bottle, to a simple water aspirator or ejector, shown at O, fig. 4.

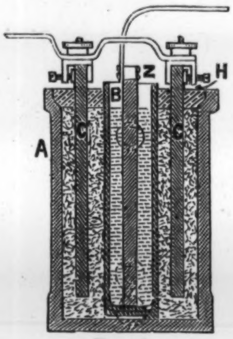


FIG. 2.

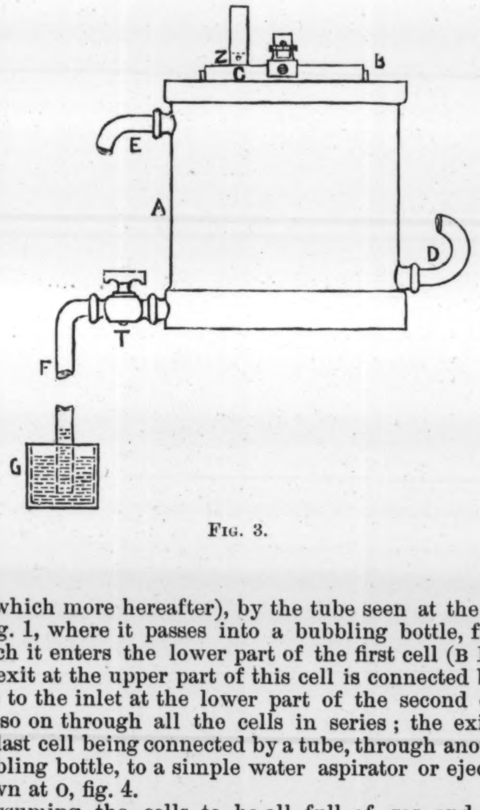


FIG. 3.

Assuming the cells to be all full of gas and the circuit closed, the gas will be equally consumed in every cell in proportion to the current; and, as the carbon cells are hermetically sealed, a vacuum is gradually produced, thus drawing further supplies of gas from the holder. If the chlorine were absolutely pure no further feeding would ever be required as the cells would always keep themselves supplied from the holder.

In practice, however, it is not possible to prevent the admixture of a small quantity of air (say 3 per cent.), and a consideration of the conditions will show that this air must first accumulate in the last cell.

The E.M.F. of this last or right-hand cell will, therefore, drop before that of the others is in the slightest degree affected; and this drop is arranged to automatically open the aspirator by means of the apparatus shown in figs. 4, 5 and 6, and to cause the removal of this accumulated air.

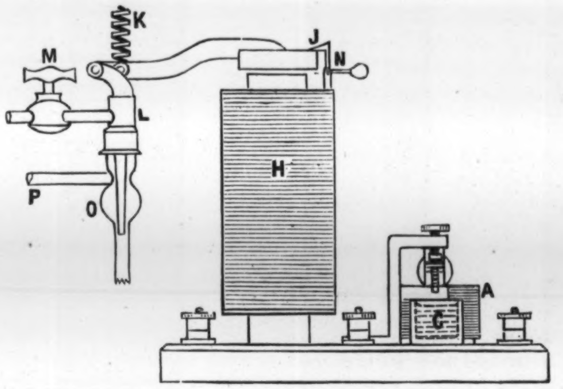


FIG. 4.

The terminals of the last cell are joined to the terminals of a high resistance magnet, A, which, when the E.M.F. of this cell is normal, has sufficient power to pull down its polarised armature, D, and the course of the main current from the battery is from the last cell through the mercury cup, C, armature, D, and pillar, E, to the outer circuit; but when the E.M.F. of this last and master cell falls by reason of accumulated air, the armature is released, and contact broken at C, so that the main current has to pass round the large electro-magnet, H, to the outer circuit. The armature, J, of this magnet is then attracted, and opens the adapted "ball valve," L, which is normally kept closed by the spring, K; water then enters the aspirator, O, drawing off the air from the last cell, through the tube, P. As soon as the air is replaced by chlorine the E.M.F. of the cell rises again, the armature, D, is

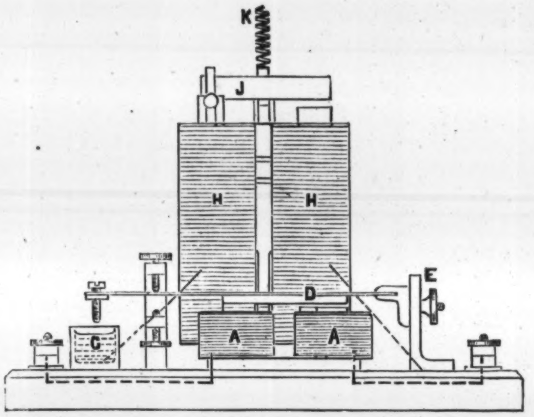


FIG. 5.

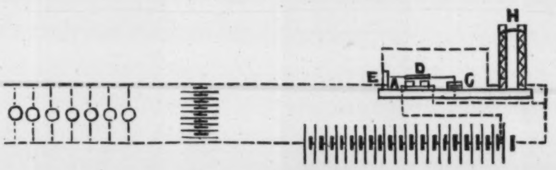


FIG. 6.—DIAGRAM.

attracted, the large magnet short-circuited, and the armature, J, released, so that the water supply and action of the aspirator is stopped.

When the battery is in regular use the aspirator "goes on" for about 30 seconds, at intervals of from one to three hours, according to the purity of the gas. The quantity of water used is therefore infinitesimal, and there is absolutely no waste either of water or gas.

The form of gas holder which has been adopted after much experiment with mechanical and liquid sealed holders is shown in fig. 7. It consists of several columns made of ordinary earthenware drain pipes cemented together and tarred on the outside.

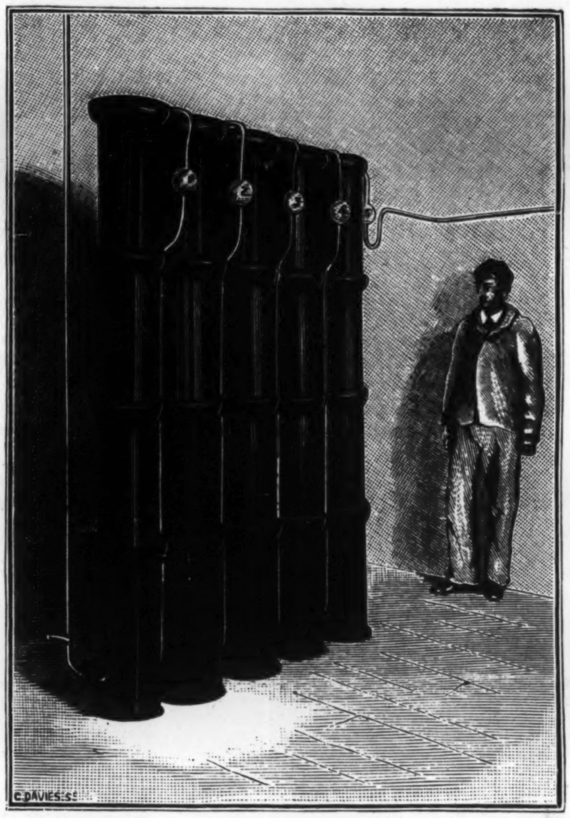


FIG. 7

The chlorine gas from the generator, which is two and a half times as heavy as air, enters the first column by a tube at the lower end, displaces the air and overflows through a lead tube to the bottom of the second column which also becomes filled from the bottom upwards; the third and succeeding columns then fill in the same way, the number employed depending on the amount of gas it is desired to store, each column of four 9-inch diameter drain pipes holding gas equivalent to about 460 watt-hours. Each of the lead tubes connecting the columns is provided with a glass bulb painted white at the back, which enables one to see at once how many columns are filled with gas, as the well-defined colour of the chlorine shows up distinctly against the white back ground. The last column is provided at its top end with an outlet tube carried into the outer air.

Up to the present time the manufacture of chlorine gas has been distinctly an operation to be carried on out of doors, and Mr. Upward fully recognised that unless the gas could be easily produced in a perfectly inodorous manner its use for household purposes would be impracticable.

The method adopted is remarkably free from any objection on this score, the whole operation being perfectly free from smell and extremely simple, so that any servant can do all that is required. The generator consists of a round outer earthenware pan, 18 in. diam. by 12 in. deep, permanently set in a sand bath, which is heated by a small gas jet or small oil flame; the quantity used of such fuel being extremely small. In this outer jar is placed a perforated earthenware vessel, containing a month's charge of manganese, the whole being closed by a cover with a water seal, which makes the generator absolutely gas-tight. In the cover is a funnel, provided with a tap, and when it is required to make gas, the funnel is filled from a vessel containing concentrated brine and from another containing dilute sulphuric acid, and the tap being turned, the contents pass into the generator.

The chlorine generated is led away through a hole in the cover to a bubbling bottle and then to the holder, a branch tube being taken off to the batteries. At the bottom of the outer pan is a tap and pipe to the drain, for emptying the liquid when spent. When the charge of manganese has become exhausted by constant repetition of the above process, the pan is filled, through the funnel, with water, so as to wash it and expel the least trace of gas. The water is then run off, the cover lifted, and the perforated vessel re-filled with fresh peroxide of manganese. The replacing of the cover then renders the apparatus fit for further generation of gas. The small size cells shown in the reproduced photo., fig. 1, have each an internal resistance of $\cdot 2^{\omega}$. They can, of course, be made of any desired internal resistance, and there is a large one at the works which gives 150 ampères on short circuit.

It is intended that the battery shall generally be used in conjunction with accumulators, so that advantage can be taken of the power the battery has of continuous working, allowing a much larger number of lamps to be run by charging the accumulators continuously day and night; while the E.M.F. at the terminals of the lamps is maintained constant with varying currents. A set of 11 accumulator cells is shown above the Upward Battery in fig. 1.

Some of the details of manufacture will show what great pains have been taken to make the battery a perfectly permanent thing and fit for use in unskilled hands.

The whole of the outer cell being covered in with cement, the carbons are a fixture, and never require the least attention; the terminals on the carbons are brass clamps, and they have been found never to corrode or give the least trouble, there being no creeping of the liquid. The zinc connection is a copper strip rivetted on to a lug cast on the top of the zinc plate, and the porous pot is thoroughly soaked in cement for an inch from the top, so that this part never gets damp or affects the cement seal. The tubes from cell to cell are perfectly insulated from the carbon inside; lead is used for the tubes, and is found to be practically unaffected by the gas, a thin coating of lead chloride forming on the inside which completely protects it. The gas is *drawn* into the cells, not *forced* in, so that there is a slight vacuum (2 or 3 inches of water) inside which effectually prevents any possibility of leakage of chlorine, which might occur if there were pressure inside. The liquid used—$Zn\,Cl_2$—(the supply of which is kept up by the action of the cells) is deliquescent, so that there is no tendency of the crushed carbon to get dry.

The description and fig. will show that apparently the utmost simplicity has been attained, and that there is nothing in the battery at all likely to get out of order.

Its E.M.F. is 2·1 volts, and is absolutely constant so long as chlorine is supplied. The whole of the chemical changes being the combustion of zinc or iron by chlorine, and that purely electrolytically, there is an entire absence of local action. This has also been proved by delicate tests, and is clearly shown by the condition of the zinc plates shown us which came out of the cells all on the same day, all used up to the thinness of a wafer, and every one to the same extent.

To the probable user of a primary battery information on the amount of attendance required and the possibility of inconvenience is of the greatest interest.

Assuming the battery and apparatus to be installed in a cellar, outhouse, yard, or other convenient position, all that a servant has to do is once a month to fill the generator with a charge of maganese, and every few days to run sulphuric acid from one tap and brine from another into the funnel, after opening the lower tap to allow the spent liquid to run off into the drain, at the same time the burner underneath may be lighted, or if preferred the heat may be arranged so that the process is continuous. The necessity for fresh or more rapid generation of gas is indicated by the colour-bulbs in the tubes between the holders, which show how many columns full of gas there are in hand.

The only other attention necessary is to fill up the cells with plain water once a week.

By using heavy zinc plates the renewal of these is only necessary once in six months or more, and, as before stated, they are all consumed alike, so that the whole are ready to be replaced on the same day.

If a battery is going to be unemployed for a considerable time all that is necessary is to turn off the taps, T, and raise the safety tube of the first bubbling bottle. The cells then draw in air instead of gas and soon stop, leaving any gas in the holders for future use, while the liquid only percolates through the pots till it is level outside and in. To start the battery again it is only necessary to open the taps, T, push the safety tube down again, and fill up with water, as plenty of zinc chloride solution has been retained in the inner cells.

With regard to the cost of the electrical energy produced by the battery, it is not to be considered that this will be so low as when obtained from an engine and dynamo; but in many cases these are perfectly inadmissible, and it is here that a reliable primary battery becomes invaluable. As to the actual working cost, for 1,000 watt-hours work done we shall require, according to the inventor's calculations, $\frac{1{,}000}{2{\cdot}1}$ ampère-hours; or, since 1 lb. zinc is equivalent to 374 A.H., $\frac{1{,}000}{2{\cdot}1 \times 374} = 1{\cdot}27$ lbs. at 2½d. per lb. = 3·2 pence, and 1·27 lbs. of zinc to form Zn Cl_2, consume $1{\cdot}27 \times \frac{35 \times 2}{65} = 1{\cdot}36$ lbs. Cl. We have no exact data of the cost of chlorine, but we believe it is generally reckoned, where used on a manufacturing scale, as costing £5 per ton. Of course, we cannot expect to get it at that rate on a small scale; but even assuming it cost six times as much, or 3¼d. per lb., we have the total cost per 1,000 W.H. as under 8d. Allowing for the battery working at a very high rate, and for loss in the accumulators, let us assume that as little as one half of the total work is done on the lamps, then taking lamps of the efficiency of 3 watts per candle, we have an outside cost per 1,000 C.P. hours of 8d. × 2 × 3, or 4s., or ½d. per hour per 10 C.P. lamp. Now, when burnt in an ordinary burner, 5 feet of gas do not give *more* than 10 C.P., so that, even taking the extreme figures for cost that we have done, we have electric light at a cost equivalent to gas at 8s. per 1,000 cubic feet.

We have no hesitation in saying that if the battery gives as little trouble as asserted, there should be a very large field for its immediate introduction; and from the cells we saw and the report of Prof. Oliver Lodge, which, we learn, is particularly favourable, we have great hopes of its commercial success, believing it to be the first thoroughly practical primary battery for electric lighting.

Telegrams to the West Coast of Africa.—The secretary of the West African Telegraph Company states that the company has now opened its Bathurst station, to which messages may be sent *viâ* Cadiz, from the offices of the Direct Spanish, Eastern, and Submarine Telegraph Companies, and from any postal telegraph station, the tariff being 5s. 11d. per word.

A DECISION IN FAVOUR OF THE BELL COMPANY.

UPON an application for a preliminary injunction in the case of the American Bell Telephone Company *et al. v.* National Improved Telephone Company *et al.*, tried in the Circuit Court of the United States for the Eastern district of Louisiana, the following was delivered as the opinion of the court:—

This cause is before us on an application for a preliminary injunction, upon bill, answers, numerous affidavits, depositions and exhibits. We heard the application discussed by the solicitors on both sides, with many adjuncts of experiment and illustration, for the period of twenty-one days, and we have striven to give to the question the study and consideration to which it is entitled, from the fact that so many of our fellow-citizens throughout the entire country are interested in its decision.

A very long discussion, in which solicitors of ability and learning participated—such as has been the one conducted before us—has one great advantage: it tends to separate, by a clear line of demarcation, that which is sound in law and sustained in fact, from that which, however plausible and forcibly urged, analysis and proof compel the abandonment of.

The complainants have urged that since the patents involved here have been the subject of judicial investigation, ending in decisions in the Circuit Courts of the United States maintaining their validity, that so far as the issues presented in those causes have been identical with those involved in this cause, for the purposes of granting a preliminary injunction to run *pendente lite*, those prior decisions elsewhere obtained are sufficient. We assent to this doctrine.

The proofs submitted to us include degrees affirming these patents by Mr. Justice Gray, Mr. Justice Matthews, Judge Lowell, Judge Blatchford, Judge Wallace, Judge Nixon, Judge McKennan, Judge Butler, Judge Acheson; with opinions at more or less length by Mr. Justice Gray, Judge Lowell, and Judge Wallace. It has been urged by the respondents, that in all these causes save one, there was either an absence of one or more of the defences here urged, or collusion between the parties and consequent imposition upon the courts; so that the degrees and decisions submitted and referred to above should not of themselves be the basis of the decision and decree here. In the Molecular case, decided by Judge Wallace last June, there has been no charge of collusion and consequent imposition. We think that these causes abundantly show that the substantial defences here submitted have been urged in several of those cases (though perhaps they have not been urged with the vigour and persistence that have characterised the defence here), and that the settled practice in the Circuit Courts of the United States would authorise the granting of the injunction *pendente lite*, upon the authority of the decrees in those cases.

We do not understand that the weight given by one Circuit Court to the adjudications of another, rests entirely upon the basis of comity; but as well upon that of recognised rights and of convenience, and that it is largely to prevent the necessity of more than one court going through with the investigation of the same facts, that the inference derived by the first court is for the purpose of determining whether or not an injunction shall go, till the final decree adopted by the other Circuit Courts. In addition to the weight to be given to the adjudications in favour of the Bell Company in other circuits, on the basis of convenience, comity, and recognised rights, it is urged that the National Improved Telephone Company, the principal defendant here, is estopped by the final decree rendered by Judge McKennan in the Pittsburg case, because it was privy to that suit, and had a day in court there.

The evidence shows that the National Improved Telephone Company, claiming to own certain patents pertaining to telephony, was the licensor of the Pittsburg Company, and contracted, for a consideration received, that in case of any litigation involving the validity of said Letters Patent, or any of them, wherein the Pittsburg Company should be a defendant, the said National Improved Telephone Company should have prompt notice thereof, and should assume control of said litigation, and at its option be made a party thereto at its own expense; that the Pittsburg suit did involve the validity of said Letters Patent; that the National Improved Telephone Company was promptly notified thereof, and did assume control of the litigation; preparing an elaborate defence and appearing therein by counsel, who were heard by the court, and that becoming dissatisfied by the refusal of the court to go behind the decrees of other circuits in the matter of a preliminary injunction, the National Improved Telephone Company "ordered the immediate withdrawal from the court of all the evidence, instruments, and documents of every character connected with the defence," and "immediately dismissed the counsel in said case."

Counsel have argued that the National Improved Telephone Company had a right to withdraw from the litigation, and that thereupon, in some unaccountable way, the company was released from all responsibility, and that complainant had no right to proceed to a decree.

We cannot avoid the conclusion that so far as the National Improved Telephone Company is concerned in this suit, it is bound and concluded by the final decree rendered at Pittsburg, and that that decree alone warrants the injunction *pendente lite* in this case, as against said telephone company and its privies.

But since we have had the cause so exhaustively presented, and we have so fully considered it, we have determined not to rest our conclusions upon the decrees in the other circuits, sufficient as we deem those to be, but to examine the questions *de novo*.

It is urged by the defence that there should be given a weight to the fact that the executive department of the government has directed the institution of a suit to annul this patent, that should lead us to refuse or defer any affirmation of the patentee's rights till the conclusion of that suit. To this we cannot assent. The executive department has not in this case attempted to adjudicate rights, nor could it in any case do more than start the judicial inquiry, and present the cause to the courts. The filing of an information cannot create a presumption of guilt. No more can the institution of a suit to annul, create a presumption of nullity. If any effect is to be given to the pendency of this suit to annul, so as to suspend any rights of the patentee, it could only result from restraining or other orders issued in that suit, where the court, having the parties and the evidence upon which the nullity is sought to be established, before it, has also the authority, if to annul, then to suspend the force of the patent.

It is necessary to consider two grounds of the invalidity of the Letters Patent of Alexander Graham Bell, No. 174,465, issued March 7th, 1876, on application filed February 14th, 1876.

First, it is urged that after the filing of Bell's application, his specifications and claim were changed in consequence of information, derived through the Examiner of the Patent Office, from the caveat of Elisha Gray, filed on the same day with Bell's application.

We have reached the conclusion that the invention is set forth in the claim and specifications as originally filed, and that, therefore, any inquiry into this question would lead to nothing which could affect the validity of the patent.

It is overwhelmingly established that Bell made the affidavit to his claim and specifications as originally filed, on the 20th day of January; and that Gray's description of his invention embodied in his caveat, was not written out till three or four days prior to February 14th, when it was filed.

The fifth claim of Bell originally filed, is as follows:—

"5. The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

In the specifications originally filed by Bell there is a figure and description and illustration of the apparatus and process.

Another mode is shown in fig. 7, whereby motion can be imparted to the armature by the human voice, or by means of a musical instrument.

"The armature, *c*, fig. 7, is fastened loosely by one extremity to the uncovered leg, *d*, of the electro-magnet, *b*, and its other extremity is attached to the centre of a stretched membrane, *a*. A cone, A, is used to converge sound vibrations upon the membrane. When a sound is uttered in the cone the membrane, *a*, is set in vibration, the armature, *c*, is forced to partake of the motion, and thus electrical undulations are created upon the circuit, E, *b*, *c*, *f*, *g*. These undulations are similar in form to the air vibrations caused by the sound; that is, they are represented graphically by similar curves. The undulatory current passing through the electro-magnet, *f*, influences its armature, *h*, to copy the motion of the armature, *c*. A similar sound to that uttered into A is then heard to proceed from L."

To simplify: In the 5th claim and the part of the specification quoted above, the applicant declares that his invention consists in this: In the discovery that vocal or other sounds, by being uttered or otherwise communicated through a receiver, and by reason of their force being made to impinge upon an armature, impart to it the vibrations of the air; that these motions of the armature cause corresponding undulations in the electrical current, so that, at the end of the circuit, similar vibrations are given to another armature, through it to the surrounding air, and through the air to the human ear. Thus voice is communicated to the electrical current, and reproduced at the end of the wire in the air, and all this by reason of the discovered fact that vibrations in the air caused by sound, are so similar to the undulations in the electrical current, that vocal sound, of whatever character itself, may be passed from air to the electrical current, and delivered again through the air by means of a receiving and a delivering, or emitting armature.

The great discovered fact was that the vibrations in the air are similar in form to the following and imparted electrical undulations, and that the undulations are similar to the ultimate vibrations.

It follows that as are the vibrations so are the undulations, whether gradual or sudden, of whatever pitch or loudness, whether constant or varying in pitch or loudness, whether caused by a single or by successive sounds. We think this a sufficient description of the process and apparatus and of the whole discovery patented, and that it neither required nor did it receive any substantial changes by the amendments subsequently made, no matter from what source suggested or derived.

Another objection urged by the defence was that the apparatus described in the specifications and illustrated by fig. 7 is not capable of transmitting articulate speech. There are affidavits to this effect, but the affidavits in favour of the capability are very strong and satisfactory, and the court itself, through its own senses, was convinced that the transmission of speech had been completely attained by means of the Bell apparatus, as exhibited by figure No. 7.

The fact that Bell's invention certainly dates from January 20th, 1876, and that it covers a speaking telephone, transmitting articulate speech by means of an undulatory, oscillatory or vibratory current of electricity, renders it unnecessary to pass upon the evidence relating to the tergiversations and claims of Gray; the alleged frauds of Bell in advancing his application for a patent; the illegal conduct and conflicting statements of Examiner Wilbur; and many alleged vices and irregularities, the evidence of which forms the bulk of the record, and apparently the main defence in the case.

At the same time, it is proper to say that in all the evidence we have found nothing that shows that Bell has done or caused to be done anything inconsistent with his right to be called an honest man, with clean hands.

If he availed himself of information derived from Wilbur as to the contents of Gray's caveat, filed on the same day as his (Bell's) application [which, however, does not appear], he had a right to do so to enable him to restrict and limit and clearly define his application; as the information shown to have been furnished, was furnished under the authority of rule 33 of the Patent Office for such purpose.

We will next consider the second ground of defence, which is that the invention of Bell lacked novelty, because it had been anticipated by Philipp Reis.

That Reis made great strides towards the discovery of the great fact or law, subsequently announced in the fifth claim of Bell, does not admit of doubt.

That he failed to reach it is equally beyond question.

Reis discovered that by means of the electrical current, sound could be received, transmitted and delivered. But it was the pitch of tones that was transmitted, and exclusively by means of an intermittent make-and-break current—a current incapable of conveying the form of sounds, protracted or varying sounds, and therefore incapacitated to convey articulate speech. His apparatus appears to have been devised in the attempt to transmit speech by electricity; but the attempt was an acknowledged failure. His apparatus under the influence of the voice or other sounds, simply broke the circuit at each principal vibration with a frequency corresponding to the pitch of the sounds.

Prof. Trowbridge says:—

"It is impossible to transmit speech electrically by means of that operation; for the reproduction of articulation requires the reproduction not merely of the *number* of sonorous vibrations, but what is technically known as their *form* or character. The electrical changes on the line wire which are to convey this characteristic from the transmitter to the receiver cannot do that unless they take note of that characteristic and bear its impress. This is as certain as any elementary proposition of geometry."

Reis apparently had no idea of operating through a continuous, uninterrupted current, which should be undulatory, *i.e.*, should be plastic, impressible, and should be the medium of receiving freely and continuously, and reproducing exactly the vibrations in the air accompanying sound, by the corresponding disturbances in the electrical current, without any intermission of the flowing of the current.

In the Jahresbericht, or the annual report of the Physical Society of Frankfort for the year 1860-61, is an account given by Reis himself of his invention and apparatus. It was presented to the court as translated in the biographical sketch of Philipp Reis by Sylvanus P. Thompson, published in London in 1883. Upon a suggestion that the translation might be imperfect, we ordered that the memoir should be obtained from the Congressional Library, and should be translated into English by J. Hanno Deiler, Professor of German in the Tulane University. We have carefully compared M. Reis's description of his invention and apparatus as given in the two translations. While differing in the words used in the two renderings, they agree in making Reis state that he uses an "intermittent current," and that "each sound wave effects an opening and closing of the current." This is made even more palpable by his illustration of his apparatus or instrument.

This is entirely inconsistent with any idea of a continuing current which should undulate, *i.e.*, be increased or diminished merely, by an apparatus so constructed as to be susceptible of being set in motion by the vibrations of the air produced by sound, and should freely receive, convey and deliver single or successive sounds, by reason of being so constructed as to be capable of being started and continued in motion just so long as the vibrations of the air lasted. He did not apply to his instrument the law—indeed, he seems not to have designed his instrument with any reference to the law—that the vibrations in one medium had an exact correspondence to the undulations in the other, not only for an instant, but for any period of time.

The merit, and, as we think, the originality of the Bell invention consisted in the discovery of this law, and in the construction of his apparatus so that when the sound caused aerial movements or vibrations, they might, without any intermission of the current, be freely transferred or translated into electrical undulations, which again, at the end of the circuit, would freely reproduce the aerial vibrations, and thus convey, single or combined, transmitted sounds to the ear, and continue to convey them without interruption, as originally uttered, whether single, combined or successive. Reis's result was that sound could be sent through the electric current like a missile through the air; Bell's result was that the electric current was a continuing connection between voice and ear, like the air itself.

A great fact in proof of the correctness of this deduction is that the instruments invented by Reis and his methods were described in many scientific papers and works, and were well known in the scientific world, and the instruments were manufactured and on sale in Paris, Vienna, and Frankfort, and had been exhibited before the British Association, and a pair were deposited in the Smithsonian Institution; and yet before 1876 there was no speaking telephone in use, nor any pretence of any.

The various reproductions of Reis and his methods, all were based upon the same defective electrical means—an intermittent circuit-breaking current—and all were practical failures for the transmission of speech, until Bell's method was discovered.

From the evidence submitted in this case it seems clear that now, in the present state of the art, neither the Reis instruments nor any reproduction of them can be made to transmit articulate speech, except by changes of some form in the instruments themselves, or by the employment of Bell's method.

We therefore, conclude, that neither Reis nor his successors anticipated the invention of Bell as set forth in the fifth claim of his application and patent, and as illustrated by fig. 7, described in his accompanying specification.

The Meucci defence that is brought forward in defendants' record on this motion, taking up 120 printed pages, was abandoned by counsel on the hearing, and no effort made to sustain it.

There remains, therefore, but the question of infringment.

This matter has not been squarely met by the defendants.

The complainants' bill alleges, and their experts testify in the opening papers, that the instrument used by the defendants consists of a microphone transmitter, and a magneto receiver which has been decided in the Spencer and Molecular cases to be an infringement.

The defendants in their answer (unsworn to), in a vague and argumentative way, deny infringement.

In their affidavits, they do not attempt to show what they were using at the filing of the bill; but they allege, in affidavits filed pending this motion, that "Defendants' apparatus, as now used, may be more particularly defined as operating in method or principle of operation under the Reis inventions of 1860-4, and under special inventions patented by Randall, May 21st, 1878, May 4th, 1880, and May 3rd, 1881." Complainants having filed affidavits showing infringements in this apparatus now used, leave was granted to defendants to file another affidavit stating fully what it is that defendants use. Under this leave an affidavit of C. A. Randall (the sixth in the record) has been filed, which contains much impertinent matter reflecting on counsel and opposing experts, but throws no direct light upon the question; but from the affiant's argument we infer that he means to say that defendants are using the apparatus above referred to. The complainants urge, and their affidavits show, that the instruments of the Randall patent, above referred to, transmit speech by means of the Bell variations of current, and we are disposed to agree with them in this view.

Let the injunction issue.

DON A. PARDEE, *Circuit Judge.*
EDWARD C. BILLINGS, *District Judge.*

Filed May 31st, 1886.

ELECTRIC LIGHTING ACT (1882) AMENDMENT (NO. 3) BILL.

House of Lords, Friday, June 18th.

ON the report of amendments to this Bill being brought up,

LORD HOUGHTON moved the following new clause to be inserted before clause 1:—

"Notwithstanding anything in the Electric Lighting Act (1882) no provisional order authorising the supply of electricity by any undertakers within the district of any local authority shall be granted by the Board of Trade except with the consent of such local authority, unless the Board of Trade in any case in which the consent of such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in such case they shall make a special report stating the grounds upon which they have dispensed with such consent."

VISCOUNT BURY pointed out that several Bills dealing with electric lighting had been referred to a Select Committee some time ago. The Committee heard a great deal of evidence not only from local authorities in various towns throughout the country, but from many other persons interested in electric lighting. The opinion at which the majority of the Committee arrived was that although it was fair that at the end of a certain number of years local authorities should be allowed to purchase electric lighting plant, yet that it would not be fair to give them undue preference. In consequence of that decision this clause, which formed part of an electric lighting Bill before the Committee, was, after discussion, deliberately rejected by a majority of the Committee. The noble lord now said that he had since received communications from the members of that Committee to the effect that they viewed with indifference the restoration of this clause in the Bill. This clause conferred on local authorities in various districts a power which had not even been granted to them by the obsolete Act of 1882. By that Act local authorities were given a power of prohibition of licences, but they had no power of prohibition in the Electric Lighting Act of 1882 for provisional orders. This clause, however, conferred on local authorities the power of voting provisional orders. After hearing all the evidence the Committee deliberately rejected the clause on the ground that it was giving local authorities undue power created now for the first time, and which did not exist in the Act of 1882. But now the noble lord came down in the last hours of a dying Parliament and tried to insert this clause rejected by the Committee. He submitted that such a proceeding was not fair. If anything was to be gained by such tactics he could imagine the noble lord making a fight for the clause; but there was really nothing to be gained by this attempt to reinstate the clause. The fact was that the noble lord wished to have something on record in favour of the local authorities, which had not yet been recorded by their lordships. He protested against the attempt and opposed the insertion of the clause.

The **EARL of CAMPERDOWN** said he wished to correct the noble viscount in two particulars. The first was that it was not quite correct to say that the Committee rejected the clause. The Committee divided evenly upon it; five voted in favour of the clause, and five against it, and by the rules of their lordships' House the decision was that the "Noes" had it.

VISCOUNT BURY: It was struck out on division.

The **EARL of CAMPERDOWN** said he wished to inform the House that in the Committee the numbers were even on the division, and that one member of the Committee was absent. He advised their lordships to accept the clause, because he could assure them that the Committee conducted its labours with the greatest possible care and considered both sides of the question in the most impartial manner. The clause did not actually alter the existing law in any sense which gave the local authorities any power; it simply recognised the existence of the local authorities, and said that their consent was to be given in the case of provisional orders, and that if they refused that consent in an unreasonable manner the Board of Trade should have the opportunity of overruling it. He supported the clause because it did not give any new power to the local authorities, and because it was a very reasonable one to insert in the Bill.

Their lordships divided, and the numbers were:—

For the clause	24
Against	37
Majority	—13

The clause was therefore rejected.

LORD HOUGHTON gave notice that he should not move the third reading of the Bill.

REVIEWS.

Electric Transmission of Energy. By GISBERT KAPP, A.M.I.C.E. London: Whittaker & Co.

(FIRST NOTICE.)

This is "a practical hand-book" *par excellence*—a book which will be read, studied, and used not by electricians merely, but by most engineers conversant with the English language. We would especially recommend this little treatise to those who are masters in matters appertaining to the mechanical transmission of power, for it is more than probable that electricity will soon take the most important place in the curriculum of experts in this particular subject. Until recently, problems on the transmission of energy to great distances could be solved by three means, principally, viz., by the hydraulic, the pneumatic, and the tele-dynamic means; each of these has its peculiarities, advantages, and disadvantages. Sometimes one of these systems was found more convenient or more economical than another, but neither of the three modes is universally applicable. Electricity may in many cases supersede water and air as regards economy, it will outweigh rope-gearing in points of convenience; but it is destined to find employment under peculiar circumstances where none of the other modes of transmission have hitherto been considered suitable.

Practical examples there are in sufficient number, and if the subject has not received the universal attention it deserves, the cause must be found in the want of a sober, systematic treatise. The literature on the electric transmission of energy has, up till recently, been rather unsatisfactory. Elaborate papers were read before scientific bodies, but they were mostly too elaborate to be of practical value. M. Marcel Deprez and others attempted to startle the world from time to time by announcements that energy amounting to several horse-power has been transmitted through several kilometres of telegraph wire; such facts, and the attendant mathematical reasoning, were very interesting in their way for the moment; but they did not serve to convey to the industrial man's mind, the full meaning which the experimenters attached to it.

Most of the attempts of transmitting energy electrically were by the general public regarded as experiments of a purely scientific nature, and of but small importance. The reports in periodicals concerning many examples were often couched in language unacceptable by the matter-of-fact engineer, and they were seldom sufficiently intelligible for the student. What we wanted was a systematic treatise, giving us a concise outline of the subject; a book which would lead us up step by step to a clearer conception of the whole business; a book which would teach us not only what has been done by others, and how they *did* the thing, but how we should do it ourselves. Mr. Kapp's hand-book gives us more than that; it goes a long way towards indicating ways and means of doing things better than they have been done before; and we venture to say that this book, small as it is, will have a most beneficial influence upon the immediate development of an important industry. We differ from Mr. Kapp on certain points, but we are bound to give him credit for excellency of style, systematic arrangement, and remarkable clearness of definition. The language of the author, to say the least, is lucid, and he displays a peculiar gift in the choice of happy illustrations; the first chapter, consisting of about 40 pages, contains the essence of modern ideas on lines of force, the relations between mechanical and electrical energy, and a capital explanation of the fundamental and practical units of measurements. The author's description of an "ideal motor" and an "ideal system of transmission" we thoroughly appreciate as giving the student in few words the characteristic outlines of a grand lesson; he will by a careful perusal of these pages get a clear notion of the elementary principles involved, and it will save him at once from drifting into that hopeless confusion which is so often produced in the brain of the student, young or old, by the reading of certain obsolete text-books.

The second chapter has some allusion to the historical development of electro-motors, but this only for the purpose of illustrating certain principles. Too much space seems to be devoted to the description of the original Siemens machine and the effects of the dead points in the "shuttle-wound" armature; no less than seven pages of descriptive matter accompanied by tables of tests with two Griscom motors are given to this discussion. The results of these experiments are of little value, in so far as this type of machine has never been of much use, unless as a toy, and we have sufficient evidence to believe that the author must be possessed of ample material of a more practical character. There is a passage on page 64 which we do not appreciate: it says, "If it be absolutely necessary to use a motor of that class, the field magnets of which are either permanent steel magnets or are electro-magnets excited independently, the waste can to a certain extent be prevented by inserting into the *armature current* an electro-magnet which will by its self-induction steady the current." The italics are our own; we assume that "armature current" is a misprint and should read *circuit*, but the whole explanation seems quite unnecessary, as no one would think of resorting to similar means in order to attain the ends indicated. If the author had carried out experiments (of a kindred nature to those mentioned on page 65 and tabulated at 66) with a couple of motors of a type and size wherein the *secondary* influences do not absorb 70 to 80 per cent. of the energy supplied at the terminals, then he would undoubtedly have modified certain general conclusions which were evidently based upon the results recorded. Supposing we run two rationally constructed motors in series with a given load, current, and speed, it does not follow that by joining the same motors in parallel and using half the E.M.F. we shall get the same current and speed. If the current were the same, then the speed should be greater than before, because the resistance of a pair in parallel must be one-fourth of that of the same pair in series; and we know that the influence of resistance upon the speed of series wound motors is very considerable.

We admire, however, Mr. Kapp's method of developing a practical theory of the dynamo or motor; his formulæ are intelligible, capable of being applied by anyone possessing an elementary knowledge of mathematics, and above all they are reliable; we have found them so, and we know of none better.

Electro-technical Photometry.—(*Die Elektro-technische Photometrie.*) By Dr. HUGO KRUSS. Vienna, Pest, Leipzig: A. Hartleben.

The present volume, which is comprised in the *Elektro-technische Bibliothek*, now being issued by the enterprising publishers, must be recognised as comprehensive and thorough-going.

Previous to the era of electric lighting, photometry seemed a very simple affair. So long as we had merely to compare the lights given out by lamps, candles, and gas burners the task was easy, since these various lights differ but little in colour and in intensity. But the introduction of the arc light gravely complicates the problem. Not only does the latter transcend the flames with which it has to be compared to an extent which at first sight appears almost limitless, but the difference of colour is a still more serious difficulty. If we cause one part of a white screen to be illuminated by an arc light and the other by a gas burner, the former portion appears of a greenish blue, and the latter of a red or orange. Now two such different sources of light appear to the eye completely incommensurable. It has long been observed that the yellow and red rays of light make a much stronger impression upon the human eye than the other colours of the spectrum. Hence even the Bunsen photometer, so valuable for comparing, *e.g.*, a gas flame with the standard candle or the Carcel lamp gives no trustworthy indications. To meet this difficulty a variety of expedients have been proposed, as we find here described. One of the most usual has been the interposition of coloured glasses between the source of light and the screen. Thus Tresca proposed glasses each of a colour complementary to the source of light. Concerning this method the author observes, very justly, that it is impossible to see how the loss of light occasioned on either hand by the intercalation of the glass plates is to be brought into calculation. Crova, on the other hand, suggests that both sources should be passed through a certain green glass, as devised by Sautter, Lemonnier & Co. But here we encounter the difficulty that as soon as the temperature of emission of an arc lamp differs from that of the one previously examined, the distribution of light in its spectrum is modified. Still this method may be regarded as applicable where the luminosities to be compared are approximately identical, *e.g.*, in testing lamps and machines of the same model working with the same number of rotations. The best expedient, however, for comparing sources of light of different colours, seems to be Wybauw's "compensation photometer," or a compensatory modification of Bunsen's instrument, devised by the author. For an account of the principles upon which these photometers are based we must refer to the work itself.

A special section of the treatise is devoted to a subject often overlooked by outsiders and amateurs, *i.e.*, measurements of sources of light at different angles of eradiation. It is the fact that arc lamps actuated by a continuous current radiate very unequally in different directions. The best arrangement, according to Dr. Krüss, is to leave both the comparison light and the photometer, and to introduce a mirror which renders the rays coming from the arc lamp, or other light in question, horizontal. An especial and needful caution is given at the close of this section concerning the necessity of preserving not merely the photometer screen, but the eye of the observer from all false lights.

The various normal and comparative sources of light are thoroughly discussed. The chief practical difficulty is the regulation of the height of the flame. It appears that during the lapse of four hours stearine candles burn with the normal height of flame only for 15 minutes, paraffin candles for 17 minutes, and spermaceti candles for 27 minutes. The mean fluctuations in luminosity are, with stearine 5·4 per cent., with paraffin 7·7, and with spermaceti 3·0 per cent. The last-mentioned material is, therefore, distinctly the most trustworthy. The author proposes to measure the height of the flame, not directly, but on its optical image as obtained in an instrument here described and figured.

In view of the manifest imperfections and irregularities of the standard candles, a variety of other normal sources of light have been brought forward, and are here discussed. Violle's unit, one square centimeter of platinum at its point of solidification, would have the preference if the practical difficulties connected with its application could be completely removed. At present it seems probable that the standard candles will be retained; but that they will be from time to to time gauged by means of the platinum unit.

In subsequent chapters the author discusses the brilliance of a light as distinct from its extent. He remarks that it is evidently not a matter of indifference whether a given quantity of light is radiated out from a small or a large surface. The brilliance (Glanz), G, is represented by the expression: $G = a \frac{J}{O}$, J being the quantity of light, O the surface of the light, and a a factor.

The measure of illumination is next considered as distinct from the luminosity of a source of light, a knowledge of which alone is evidently insufficient to give us a standard of the illumination actually produced.

Want of space, however, does not allow us to carry any further our examination of a work which must be strongly recommended not merely to electricians, but to all persons who have to concern themselves with photometry.

A very valuable feature is the copious index of works and memoirs bearing on the measurement of light, extending from 1729 down to the present year.

The Technics of Telephony (*Die Technik des Fernsprechwesens.*) By Dr. J. WIETLISBACH. Vienna, Pest, and Leipzig: A. Hartleben.

This work which forms the 31st volume of Hartleben's "Electro-Technical Library," takes a well-defined position. The author distinctly confines himself to a discussion of those apparatus and arrangements which have been found useful in practice. For the historical development of the telephone, the reader is referred to a former volume of the series. Nor are the applications of the telephone other than the transmission of verbal communications here taken into consideration. For information on the other applications of the telephone, such as in electro-dynamic measurements, in the examination of metals with the induction balance, in the detection of subterranean streams of water, and in physiological experimentation, other authorities must be consulted.

The author describes firstly the apparatus for the transmission of speech to a distance, including the telephone in the strictest sense of the word, the microphones of Hughes and Edison; signals, the battery, arrangements for protection from lighting, systems of apparatus and necessary appliances. A second chapter discusses the necessary conductors, ærial and underground, supports, wires, the humming of the wires, the effects of induction, &c. The humming and "singing" of telephone wires passing over the ridge of a house is certainly not a succession of accentuated sounds, like the ringing of church bells, the barking of dogs, a young lady "practising" in the next house. But now noise is clearly recognised as one of the factors of debility in our city populations, any addition to its sum-total is to be deprecated, and the attention which the author pays and directs to devices for deadening this humming sound is fully justified.

As regards telephony at long distances, Dr. Wietlisbach remarks that if messages are sent with strong microphones through long iron wires, as the line becomes longer one consonant after another fails and only the vowels are reproduced.

A line of 100 kilometres in length is probably the limit at which all the consonants are reproduced. On a well insulated line the vowels may penetrate to the distance of 500 kilometres, but not a word can be understood. Hence for longer distances copper conducting wires should be used. In his concluding remarks the author holds that the difficulties in the way of telephony at long distances are not technical but financial. The line, *e.g.*, from Chicago to New York in order to be remunerative would have to earn 5s. per minute of the entire 24 hours. Hence the price even for a short conversation is £2 10s. But the same intelligence can be communicated by telegraph for a tenth part of this sum with approximately equal speed.

The work is, throughout, well and profusely illustrated, and all the more important appliances are clearly described.

Traité Pratique d'Electricité Industrielle. Par E. CADIAT and L. DUBOST. Second Edition. Paris: Librarie Polytechnique Baudry et Cie, 15, Rue des St. Pierres.

This new edition, the original of which we reviewed in the No. of the REVIEW for November 1st, 1884, has practically been arranged on the same lines as the old. The authors have, however, suppressed all descriptions of apparatus and all accounts of experiments which have an historical value only. Many new facts, on the other hand, have been given, so as to bring the work, as far as possible, up to date.

Journal of the Society of Telegraph-Engineers and Electricians, No. 61. E. and F. N. Spon, 125, Strand.

This number contains the following papers, with discussions on the latter, read before the Society:—"Economy in Electrical Conductors," by Profs. Ayrton and Perry; "Uniform Distribution of Electric Power from a Uniform Conductor," by Profs. Ayrton and Perry; and, "Electric Lighting by Means of Low Resistance Glow Lamps," by A. Bernstein. The "Original communications" are:—"Delany's System of Synchronous Multiplex Telegraphy," by W. H. Preece, F.R.S.; "The Relation of Electric Lighting to Insurance," by C. J. H. Woodbury, Boston, Mass. The usual "Abstracts" complete the number.

The Elementary Principles of Electric Lighting. By A. A. CAMPBELL-SWINTON. London: Crosby, Lockwood & Co., 7, Stationers' Hall Court, Ludgate Hill.

The aim of the author has been to supply the requirements of those who are anxious to obtain an elementary knowledge of the primary principles of electric lighting, but who have neither the time nor the inclination to read the subject at the length at which it is treated in text books. The author's attempt is not, we think, a particularly happy one, though there are undoubtedly good points in the work. The many attempts which are made to impart information of the kind in a few pages are all more or less failures, in our opinion. Those who, as the author says, "have neither the time nor the inclination" to read up the subject properly, had better, we think, leave it alone. Mr. Swinton's work contains but 28 pages of matter divided as follows:—1. Closed Hydraulic Circuit; 2. Electric Circuit; 3. Galvanic Battery; 4. Electro-magnet; 5. Galvanometer; 6. Electric Arc; 7. Swan Incandescent Lamp; 8. Arrangement of Lamps in Series; 9. Arrangement of Lamps in Parallel Circuits; 10. Complete Electric Lighting System.

MR. J. B. DANCER.

SOME days ago there appeared in the Manchester papers a letter from Mr. J. B. Dancer, recalling to our notice the large share that gentleman took in the introduction of photography to Manchester and Liverpool. But photography is only one of the many arts and sciences indebted to him; and though it is neither possible nor necessary to give a detailed catalogue of those services, the list that follows cannot be without interest to the Manchester public, whose townsman Mr. Dancer has been for more than half his lifetime.

Of his connection with photography he has himself written, though in the modest and imperfect way one would expect such a man to write about himself. There is the stereoscopic camera with twin lenses, which as he explained, he was the first to make. He invented microscopic photographs, which so much delighted and astonished us 25 or 30 years ago. He also introduced photography to the magic lantern, being the first to show a photographic transparency on a screen; and the exhibitions which men of middle age will so well remember at the Mechanics' Institution, when Mr. E. Hutchins was the secretary, were largely due to Mr. Dancer, and were the first ever held. The lantern itself is also indebted to him, not only in its optical parts and its construction generally, but also particularly in the application of the oxy-hydrogen light, and for a dissolving gas tap, which saves half the gases and produces the best dissolving effect.

Then there should be mentioned, as of much greater importance than the above, the automatic "contact breaker," used probably by the million at this moment, in every induction coil in the world. Prior to Mr. Dancer's invention, contact used to be made and un-made by hand, in a vessel containing mercury. The first helical coil with the vibrating interrupter was constructed by Mr. Dancer, and was exhibited long after by him at one of the soirèes of the British Association, when the meeting was held in Manchester.

When Mr. Dancer established himself as an optician in Manchester, his presence soon made itself felt amongst the few microscopists then living in the district. Good microscopes were then costly, and worthless ones very common. Mr. Dancer successively brought out several forms of instruments, as excellent in their mechanical and optical arrangements as they were moderate in price. Instruments fully equal to the requirements of original research were thus brought within the reach of many whose observing faculties were more conspicuous than their financial resources. It would be difficult to over estimate the stimulus which Mr. Dancer thus gave to Manchester microscopy; it cannot be doubted that the present energy of our local microscopists is the direct outcome of the impulse which their means of research then received.

Not only so, but the value of the new instruments was recognised outside our city, by such men as Mr. Quekett, Dr. William Carpenter, Dr. Gideon Mantell, and Mr. Bransby Cooper, all of whom were familiar with their excellent qualities. These facts suggest that Mr. Dancer's claims upon us are worthy of recognition by many now treading in paths which he made easy for them, though personally a stranger to them.

This is a considerable catalogue for one man to be concerned in; but it does not complete the list. Mr. Dancer mentions the porous jar in his letter, which he was the first to suggest in the Daniell's battery, and which it is difficult to over estimate the importance of. There are also his improvements in levels; the speed counter; an instrument for testing coloured fabrics for calico printers; improvements in air pumps; improvements in voltaic batteries, &c., &c.

It is sad to have to say, that notwithstanding Mr. Dancer's talents and achievements, he is now living in very straitened circumstances, is moreover afflicted with almost total blindness, and therefore unable to follow the optical business to which his life has been devoted. It is not an unusual thing for a man of great mechanical ingenuity and skill to be an indifferent man of the world, and so it has been with him; as a business man he has been a failure. He has made improvement after improvement, invention after invention, any one of which might in "pushing" hands have made a fortune; but more interested in science than in money-making, he has allowed the golden chances to become public property, and has thus remained poor himself, while the world has reaped the advantage of his labours.

Mr. Dancer is now in his seventy-fourth year, and we beg respectfully to suggest that in his hour of darkness the world should pay back to him something for that which it has freely received at his hands.

We propose that a subscription be commenced forthwith, with the object of purchasing an annuity, payable during the joint lives of himself and Mrs. Dancer.

We are willing to form the nucleus of a committee for carrying out this project, and invite all friends to Mr. Dancer to join us in obtaining subscriptions. Mr. T. R. Wilkinson, manager of the Manchester and Salford Bank, has consented to act as treasurer, and cheques can be paid to his order, or payments to the credit of the "Dancer Subscription," will be received at the Bank.

J. P. Joule, LL.D., F.R.S., Sale, near Manchester.
Prof. W. C. Williamson, LL.D., F.R.S., Owens College.
Prof. Balfour Stewart, LL.D., F.R.S., Owens College.
John Dale, F.C.S., Cornbrook, Manchester.
Leo H. Grindon, Manchester.
S. Platt, J.P., Oldham.
Charles Bailey, Hon. Treasurer Manchester Literary and Philosophical Society.
James Birchall, Hon. Secretary Liverpool Literary and Philosophical Society.
Abel Heywood, Jun., Higher Broughton, Manchester (Hon. Sec. *pro tem.*)

NOTES.

Electric Lighting of Shops in Newcastle.—The large and commodious stores being erected by the Newcastle Co-operative Society, and which are nearly completed, in Newgate Street of that city, are to be lighted by four Gülcher arc electric lamps of "2,000" candle-power each, and 102 incandescent lamps of "20" candle-power each.

The Electric Lighting at Paddington.—Last Friday a number of representative colonial gentlemen visited the premises of the Great Western Railway, Paddington, at the invitation of the Telegraph Construction and Maintenance Company, for the purpose of viewing the electric lighting installation. The visitors included Sir George and Lady Bowen, Mr. Bosisto, Mr. Despeissis, Mr. Glen Engelhardt, Mr. George Hawkins, Mr. and Mrs. Malcolm Fraser, Sir Peter and Lady Lumsden, and Mr. Schute. The various features of the machinery and lighting apparatus were explained to the visitors by Mr. J. E. H. Gordon, whose inventions are principally adopted in the system of electric lighting in operation at Paddington.

Electric Light Experiments.—At the last meeting of the Bournemouth Improvement Commissioners a letter was read from Messrs. Laing, Wharton, and Down recommending the experimental introduction of the electric light into Bournemouth. After some discussion it was resolved on the recommendation of the committee, that facilities should be given for experimental electric lighting at the expense of the applicants, although the Board were not inclined to increase the present cost of lighting the town.

Temporary Lighting on Board Ship.—The electric light was temporarily installed on board the *Alexandra* upon the occasion of the banquet given on the 11th inst. by H.R.H. the Duke of Edinburgh to the flag officers and captains of the ships of various nationality at the time in Suda Bay which have been engaged in the blockade of the Greek ports.

Electric Lighting and Crime.—According to the *Diamond Fields Advertiser*, South Africa, the electric light played an important part in the criminal proceedings relating to the dynamite conspiracy. According to one of the witnesses, he was able to identify the accused because the latter got directly between him and an electric light, which was at a distance of some 360 yards. Mr. Preece has said that an increase in electric lighting would lead to a decrease of policemen. If it does not have that effect, it may at any rate cause policemen to be oftener visible when their services are required.

The Brush Cut-Out.—Tests with the Brush multiple series cut-out at the station of the Brush Electric Light Company, of Boston, are stated to have been very successful. An account says that the lamps had already shown a life of 800 hours and were still burning.

Electric Lighting for San Francisco.—The street lighting committee of San Francisco have asked for "proposals" for maintaining 28 electric light masts for two years from August 1st next. One mast is to be 40 feet high, and the rest 150 feet.

The International Cable Company. — Since the publication last week in the *Financial News* of portions of a prospectus of this company, stated to be in circulation on the Continent, two of the gentlemen whose names were given as directors have written denying any connection with the company.

The Proposed New Zealand-Australia Cable. — According to a contemporary three companies have signified their willingness to construct a proposed new cable from New Zealand to Australia for £180,000!

The Manufacture of Bell Telephones.—The gross output of telephones of the American Bell Telephone Company for May was 4,555, an increase of 848 upon the output of the same month in the previous year. The gross output for the period from December 21st to March 20th last was 17,054, an increase as compared with the corresponding period of the previous year of 2,732.

Canadian Telegraph Lines.—*Bradstreet's* says :—"The proposed deal between the Canadian Pacific Railway Company and the Western Union Telegraph Company in regard to the telegraph lines of the Dominion has for the time being come to naught. The negotiations were brought about as a consequence of the establishment by the Canadian Pacific directors of a telegraph line along the whole of their system from Quebec to British Columbia, the existence of which, with branches now contemplated, in the absence of some agreement, is certain to severely interfere with the practical monopoly of the Canadian telegraph business now enjoyed by the Western Union.

A New Telegraph Office.—For some time past dissatisfaction has existed among the inhabitants of Cattedown on account of the absence of a telegraph office. Sir Edward Bates, M.P., was got to interest himself in the matter, with the result that a promise has been received from the Postmaster-General that a telegraph office shall be opened there, especially with a view to the convenience of the captains of merchant ships lying at anchor in the vicinity.

Colonial Telegraphs.—Mr. J. Sivewright is announced to read a paper on "Colonial Telegraphs," on July 9th, in connection with the Colonial and Indian Exhibition Conference.

Telegraph Revenue.—The receipts on the telegraph service from April 1st to June 19th, 1886, amounted to £335,000; from April 1st to June 20th, 1885, they were £355,000.

The Libel on Mr. Watt.—At Westminster, on Saturday, Richard Fyfe, engineer, was charged, on remand, with libelling Mr. Hugh Watt, one of the members of Parliament for the City of Glasgow. Mr. J. G. Grain, who appeared on behalf of the prosecutor, stated that since the prisoner had been in custody, after his rearrest, consequent on his absconding from his bail, he had written letters to Mr. Watt, begging his forgiveness, and offering the most ample apology. The learned counsel read the communications, which were dated from Holloway Prison. The defendant therein expressed his humble regret for that which he had penned, stating that there was not the slightest foundation for the allegations he had made. Mr. Partridge remarked that there was some aggravation of the offence, because the charges were reiterated by the accused when he was first in custody. Mr. Grain said that Mr. Watt was willing to withdraw from the prosecution under all the circumstances. Mr. Partridge discharged the defendant, remaking that he should most certainly estreat his recognisances for absconding from his bail if there was any application made with that view.

Our Columns.—This number of the REVIEW, being the last of Vol. 18, contains the index. As a consequence, we have necessarily been obliged to leave over all reference to the evidence in the incandescent lamp patent case, the "Strange History of a Dynamo," and other matters of interest.

Electric Light Fire Damp Indicator.—With reference to the apparatus which we describe on page 588, we would remark that the principle involved in the instrument is an old and well-known one, and it possesses the defect (which we believe must exist in the apparatus in question) that it does not enable a *gradual* accumulation of fire damp to be indicated.

Volk's Electric Railway.—The proposal of Mr. Volk to construct a passing place on his railway again engaged the attention of the Brighton Town Council at their last meeting, when the Works Committee reported that the resolution of the council excepting from approval their recommendation that Mr. Volk's application should not be granted had been under their consideration, and it was resolved that the permission should be granted, subject to the same conditions as those upon which the existing railway is permitted. A rather animated discussion was initiated, Councillor Carpenter objecting to any fresh concession being granted to Mr. Volk, and moving an amendment to the committee's report. It was suggested that certain members of the corporation used the electric railway gratuitously, and that, indeed, free passes had been sent to every member of the council. The necessary permission was ultimately granted to Mr. Volk by an overwhelming majority. Councillor Carpenter would not, however, allow the matter to stop there. He had a fresh grievance. He said that he had sent a letter to the committee enquiring by whose authority the beach adjoining the electric railway had been levelled on the east side of the Charlotte Street groyne; and the committee resolved that he should be informed that the work had been commenced without their authority, and had consequently been stopped. He contended that originally he was given a different version of the matter, and thought that private individuals should not be allowed to take hold of public property. An explanation having been given, the wearisome discussion ended.

Electric Locomotion in Philadelphia.—A daily paper states that an experimental electric motor car has recently been run in Ridge Avenue, between Thirty-Second and Thirty-Third Streets, Philadelphia, by the Union Electric Company, the speed attained being at the rate of nine miles an hour. The system employed is that of underground electrical transmission. A conduit 4½-inch wide by 9-inch deep, and having a central slot similar to those used in cable roads, extends along the centre of the track. This has been laid on concrete, and covered with Portland cement. At suitable intervals connections are made with the sewer in order to allow the rain water to escape, or the conduit to be cleansed out if that operation should become necessary. Copper conductors, quarter of an inch thick by one inch wide, run along each side of the slot. Grooved pieces of channel iron are attached to the bottom of the conductors. A so-called "traveller," supported by wheels, runs in the slot, and is provided with two springs, which slide along the channel irons on each side of the slot, and thus receive the electric current. The traveller is connected to the car by small chains. From its centre wires extend into the car, connecting the motor with the copper conductors in the conduit, by which the electric circuit may be closed. A regulator on the car controls the current and permits the car to be driven in either direction. The estimated cost per day of running the electric car is stated to be $1.84, as compared with $4.74 for horse traction, both amounts not including wages. The cost of ten miles of electric railway on this system, and 50 cars, is stated to be $175,000 (£35,000).

Primary Batteries.—Mr. Sidney F. Walker occupies a considerable portion of our space this week with strictures on the Upward and the Schanschieff batteries, and in praise of that of Maquay. Doubtless, Mr. Upward can reply to all the points raised in our correspondent's lengthy communication, and Mr. Schanschieff is also able to take care of himself.

The Gordon Method of Lighting.—We understand that there is a probability of the Gordon system of electric lighting being introduced into the United States as a rival to that of Edison. The American electrician should construct a machine giving reverse currents, it could then be offered to the public as an "alternative" system.

An Unfortunate Company.—The building of the Royal Electric Company, Montreal, was burnt down last month. The total damage is stated to have amounted to $50,000, but was covered by insurance. This company has been unfortunate in regard to its premises. The building it formerly occupied was burnt down, and that which has just been destroyed was inundated during the recent flood.

Strong Plea for Overhead Wires.—The *Baltimore Herald* says it is no use talking about taking down the telephone poles till the anarchists have left the country. The lamp posts are not high enough; besides, they will only support one at a time.

Electrical Elevated Railroads.—The committee on street railways of the Massachusetts Legislature, it is stated, will report that the time has not yet come to say that electrical elevated roads are a success, and that they think the methods should be more fully developed before any charters are granted.

Collapse of the Electric Lighting Bill.—Many of our readers will probably be glad to learn that the Electric Lighting Act Amendment Bill which the House of Lords Select Committee evolved after a strangely elaborate and secret enquiry has, after all, come to nothing.

The Electric Lighting of Chelsea.—The Board of Trade has granted a provisional order, which will require the confirmation of Parliament, to the Chelsea Electricity Supply Company, Limited, with powers to supply, under certain conditions, an area comprising the whole of the parish of Chelsea, exclusive of the outlying district of Kensal Town. The order stipulates that within one year from the commencement of the powers the company shall set aside £100,000 as separate capital for the purpose of carrying out the powers granted in the order, failing which the board reserve to themselves the right to revoke the order upon such terms as they think fit. Provision is also made for regulating the charges leviable by the company, and for testing, by the local authority, the supply of electricity.

New Electric Fuzes.—The Electric Blasting Apparatus Company, of Cinderford, Gloucestershire, writes to us as follows:—"We notice reference in your issue of the 11th to a 'New Electric Fuze,' by MM. Scola and Ruggieri, extracted from the *Comptes Rendus*. We feel compelled in justice to ourselves to ask to be allowed to say we have been doing an extensive business (as enclosed testimonials will show) for some years past with a fuze made on this principle, more particularly in connection with coal mining and subaqueous work."

The Upward Primary Battery.—We were conversing the other day with a gentleman of the highest eminence in the electrical world, and he expressed himself to the effect that he considered this battery as being a great advance on anything which had been previously accomplished. We imagine that extensive use could be made of Mr. Upward's invention in America, where the price of gas averages about 9 shillings per 1000 cubic feet.

Bleaching by Electricity.—In the *Dyer and Calico Printer* for May 15th, Mr. W. Watson concludes a series of articles on bleaching by electricity, and he arrives at this conclusion:—"We may say that we do not think it possible any development will ever take place in the bleaching of vegetable fibre by electricity of sufficient importance to be worth the attention of practical men." What say Messrs. Paterson & Cooper to this sweeping assertion?

Colonial and Indian Exhibition.—At the conference on Wednesday, June 23rd, a paper was read by Mr. W. Lant Carpenter, on "The Position of Science in Colonial Education." The colonies to which Mr. Carpenter had directed his attention were:—Canada generally; in South Africa, the Cape of Good Hope and Natal; Western and South Australia, Victoria, New South Wales, Queensland, New Zealand, and Tasmania, the last of which, unfortunately, was not represented at the present exhibition. An account of the present condition of scientific education in each of these colonies was given. As a general conclusion, Mr. Carpenter thought that the claims of science to a place in state-aided primary education were more fully recognised than in the old country, and this, not merely because it was the only foundation upon which a system of technological education could be securely built, but for its value in drawing out the minds of the pupils. In the colleges and universities of the older colonies, the classical and academic influence was still very strong, while in the newer ones the claims of scientific education to be put on an equal footing with literary were recognised. The author concluded his paper by throwing out the suggestion that, if there were grave and practical difficulties in the way of an Imperial federation of the Australian colonies, the establishment of an Australian Association for the advancement of science, somewhat on the lines of the British and American Associations for similar purposes, might not be beyond the reach of practical scientists, and he was strongly of opinion that such a federation would tend to strengthen "the position of science in colonial education."

Electrical Measuring Instruments.—In the latest issue of *Centralblatt für Elektrotechnik* there appears an article on tramway traction, and special mention is made of a trial of the Julian system in Hamburg. This, as our readers may remember, was tried in competition with steam and compressed air engines during the Antwerp Exhibition, coming out of the contest ahead of its rivals on nearly every point. Our contemporary speaks of some measurements being made with instruments by Paterson and Cooper, Breguet, Ayrton and Perry and others, the readings given varying between 20 and 30 per cent. The Julian system might evidently be made very good or very bad according to taste with such a charming set of apparatus to select from.

Telegraphic Communication.—"J. E. K." writes to the *Times*:—"If I might generalise from a single district I should say that the state of our telegraphic communications calls for immediate and serious attention. A complaint which I made to the West District office in Vere Street has brought to my knowledge the fact that the number of blunders which draw forth similar complaints to that office alone amounts to 30 or 40 a day. Possibly some of these may be attributable to the senders—mine was not; but to set against this we must take into account those about which the offices hear nothing. Telegraphic communications are for the most part about matters of more than ordinary importance and such as need more than common expedition; but if addresses containing three figures, say 184, are wired with only one (8) what chance is there of the message reaching its destination within any time upon which the sender can reasonably calculate? This is one specimen of the variety of blunders to which we shall continue to be liable until greater care is exercised, and more efficient agents are employed." A little experience of our own a week or so ago still rankles in our mind, a grievous error in the transmission of a telegram from London to Somersetshire having caused a degree of inconvenience and anxiety which it is hard to calculate.

The New York Underground Wire Commission.—Renewed interest in the underground question is caused by the appointment of Mr. Roswell P. Flower to fill the vacancy on the New York Commission created by the death of Mr. Loew. The fact that the newly-appointed commissioner acknowledges his entire ignorance of the technical questions involved, states the New York *Electrician and Electrical Engineer*, will by no means hasten the work, unless he accepts for granted the conclusions already arrived at by the other members of the commission, but which they have not yet felt sufficient confidence in to publish as an official decision. Mr. Flower expresses the opinion that the law should be enforced, but his views upon this point may be slightly modified after he has carefully studied the provisions of the Act. If he will take the 118 plans which have been submitted, and retire to his accustomed summer resort, and carefully digest them, he will doubtless return next autumn fully convinced that his mind is not as clear upon the question of enforcing the law as it is at the present time.

Electricity and Fire.—Mr. Alfred Thompson who recently read a paper on "Electricity as a Safeguard against Fire," before the Balloon Society of Great Britain, thus sums up the advantages of the Automatic Electric Fire Extinguisher :—

1. Its instantaneous and certain action on the occurrence of a fire, either during the day or night. In this respect it is far ahead of all previous inventions.

The records of insurance companies show that while three-fourths of the fires in mills occur in the day time, more than three-fourths of the total loss has been caused by fire which started at night or on Sunday.

2. Its perfect automatic action and independence of human aid, which is of the highest importance, as frequently fumes of smoke are such as to endanger human life.

3. It confines a fire to the point where it originated.

4. The discharge of water is limited to the site of the fire, but can, if desired, be extended as a matter of precaution in an area immediately surrounding it by bringing into action other extinguishers in its immediate vicinity. This can at once be done with perfect ease and safety.

5. The apparatus admits of frequent testing to prove it is in working order. This can be done during working hours without interference to the occupants, or disturbance or damage to the furniture or fittings of the room. The testing does not necessitate any expense in the replacement of any part of the apparatus.

6. It is a perfectly reliable fire alarm.

7. It does what no other automatic fire alarm can do, viz., shows on a board plan the exact site of the fire indicated.

If, therefore, we may be guided by the advantages resulting from the application of electricity in all the above-mentioned cases, it is fair to infer that the application of electricity in the actuating of sprinklers will result in a still further saving.

NEW COMPANY REGISTERED.

Electro Metal Extracting, Refining and Plating Company, Limited.—Capital, £50,000 in £1 shares. Objects :—To extract and refine metals by the electro process and to galvanise and plate iron and other metal goods by electrolysis or otherwise. Signatories (with one share each) :—T. F. Veasey, 76, Finsbury Pavement ; J. J. Done, 10, Finsbury Square ; A. Odell, 13, Kempsford Road, S.E. ; B. Wyand, Edgware ; A. W. Pym, 43, Ashburton Grove, Holloway ; T. Fenwick, 172, Fleet Street ; J. Marsh, 4, Wellclose Square. The first directors are—Messrs. F. B. Welch, C. S. Brand, T. Veasey, and T. Fenwick ; qualification 50 shares ; remuneration £50 per annum, with an additional £50 fee for the chairman. Registered 22nd inst. by Thos. Veasey & Co., 76, Finsbury Pavement, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

River Plate Telephone and Electric Light Company, Limited.—The annual return of this company made up to the 14th inst. was filed on the 21st inst. The nominal capital is £100,000 in £5 shares. 12,602 shares and 280 share warrants have been taken up, and the full amount has been called thereupon. The calls paid amount to £32,360, and £32,050 is considered as paid upon 6,410 shares.

Telpherage Company, Limited.—The annual return of this company made up to March 31st was filed on the 16th inst. The nominal capital is £50,000 divided into 2,500 A and 2,500 B shares of £10 each. £10 per share has been called upon the B shares, the calls paid amounting to £15,366 5s. and unpaid to £793 15s.

Swan United Electric Light Company, Limited.—The registered office of this company is now situate at 14, Albert Mansions, Victoria Street, S.W.

Alfred Slatter, Limited. — An agreement dated April 30th and registered 3rd inst. provides for the purchase of the business of electrical engineer, carried on by Mr. Alfred Slatter at Leadenhall Chambers, St. Mary Axe, and Sekforde Street, Clerkenwell, the consideration being £2,000 in fully paid shares. The vendor is appointed sole director and manager for so long as he may be willing to act at a salary of £250 per annum.

Bright Platinum Plating Company, Limited.—By an agreement dated 22nd ult. and filed on the 17th inst., the company will purchase from W. A. Thoms and J. S. Beeman the provisionally protected invention for improvements in the deposition of platinum by electricity (No. 4,553 dated April 1st, 1886). The purchase consideration is £300 in cash to be invested in shares of the company, and 600 fully paid shares.

CITY NOTES.

The Eastern Extension, Australasia, and China Telegraph Company, Limited.—This company announces that the coupon due July 1st on its five per cent. Australian Government subsidy debentures will be paid on and after that date at Messrs. Barclay, Bevan & Co.'s Bank. Coupons must be left three clear days for examination. The same company also announces an interim dividend for the quarter ended March 31st last of 2s. 6d. per share, free of income tax, payable on July 15th.

South African Brush Electric Light and Power Company, Limited.—The liquidator announces that a third and final return to the shareholders of 1s. 9½d. per share is now payable at his office, 5, Copthall Buildings, E.C.

British Electric Light Company, Limited. — An order has been made for the winding up of this company.

TRAFFIC RECEIPTS.

The West India and Panama Telegraph Company, Limited. The estima receipts for the half-month ended the 15th June are £2,400, as compa with £3,050 in the corresponding period of 1885.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending June 18th were £2,110, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

NEW PATENTS—1886.

7736. "Induction telephone repeaters." S. F. Shelbourne. Dated June 9.

7737. "Electric arc lamps." H. Moehring. Dated June 9. (*Complete.*)

7748. "Lightning guard for poles and supports carrying electrical conductors." A. R. Bennett. Dated June 9.

7749. "Telephonic switching apparatus." A. R. Bennett, C. G. Wright. Dated June 9.

7795. "Electric lamps." H. N. Bickerton. Dated June 10.

7806. "Producing intermittent electric light." P. Jensen. (Communicated by K. Pollak and G. Wehr.) Dated June 10.

7848. "Secondary batteries." C. Smith. Dated June 11.

7851. "Transmitters or receivers for mechanical telephones; making same." J. Fraser. Dated June 11.

7860. "Dynamo-electric machines." S. P. Thompson. Dated June 11. (*Complete.*)

7913. "Coupling engines and dynamos together." R. C. Parsons. Dated June 12.

7916. "Mechanical telephones." F. J. Mudford. Dated June 12.

7919. "Incandescent electric lamps." R. Kennedy, R. Dick. Dated June 12.

7953. "Regulating currents generated by dynamo-electric generators." W. Geipel. Dated June 15.

7966. "Secondary batteries acting as accumulators of electricity." E. Commelin, G. Bailhache, C. Desmazures, A. L. de Voiloy, L. de Bousignac. Dated June 15.

7983. "Constructing and automatically regulating primary batteries." A. Serrailier. Dated June 15.

7989. "Electrical membrane telephones." Stanhope Company, G. L. Anders. Dated June 15.

7990. "Diaphragms or tympans for electrical telephones, known as membrane telephones." Stanhope Company, G. L. Anders. Dated June 15.

7997. "Accumulators of electricity." J. E. Chaume, P. Perrier. Dated June 15.

8003. "Dynamo-electric generators." L. B. Atkinson, W. T. Goolden, A. P. Trotter.

8007. "Propelling carriages by combined use of compressed air and electricity." W. Hutchinson. Dated June 16.

8019. "Dynamo-electric generating apparatus for electric lighting, &c., on board ships." G. A. Smith. Dated June 16.

8029. "Telephonic instruments." H. Withy. Dated June 16.

8040. "Regulating alternating electric currents." C. Zipernowski, M. Deri, O. T. Blathy. Dated June 16.

8084. "Voltaic batteries." A. M. Clark. (Communicated by C. R. Goodwin.) Dated June 17.

8085. "Electrical thief-proof lock." R. D. Bowman. Dated June 17.

8137. "Incandescent electric lamps." A. Swan. Dated June 19.

8151. "Making carbons for electrical purposes." J. G. Tongue. (Communicated by J. Kirby.) Dated June 19. (*Complete.*)

8156. "Helical carbons for electric lamps." W. R. Johnston. Dated June 19.

8181. "Electric clocks." J. G. Lorrain. Dated June 21.

8226. "Secondary batteries or accumulators." A. M. Clark. (Communicated by A. E. Peyrusson.) Dated June 22.

8230. "Apparatus or instruments for finding the variations and deviations of the compass." R. E. Harris. Dated June 22. (*Complete.*)

8246. "Insulators for supporting electrical conductors." A. R. Bennett. Dated June 22.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1886.

2081. "Improvements in and connected with telephonic apparatus." L. de Combettes. Dated February 12. 8d. Relates to an electric apparatus serving to form telephone relays or stations, and to print telephonic messages upon a strip or band which is gradually unwound for that purpose. The improved apparatus is based upon the principle that a body increases in volume when magnetised, and that such increase is in a direct ratio with the extent to which it is magnetised.

2959. "Improvements in electrical brushes." W. T. Whiteman. (Communicated from abroad by W. H. Miles, junior, and J. C. Aiken, both of New York.) Dated March 2. 8d. Relates to brushes, particularly the hair or flesh brushes commonly used for toilet purposes, and consists in combining with the brush an electrical apparatus or generator, adapted to be operated automatically in using the brush to give a succession of discharges.

3133. "Improvements in and relating to electrical conductors." W. R. Lake. (Communicated from abroad by H. A. Clark, of America.) Dated March 5. 8d. Consists partly of an electric conductor, composed of a bare or core wire, of steel or iron, or of other suitable material that is a good conductor of electricity, and preferably one that combines strength and durability, having one or more grooves along its length either longitudinally or spirally, one or more insulated electric wires lying or being disposed in each of said grooves; a covering or coating of any suitable insulating material, such as India-rubber or gutta-percha, or the like; and an outside covering such as silk, cotton, or other suitable fibrous material, either braided, wound, or wrapped spirally or longitudinally thereon, or applied in any other suitable manner; or such as lead applied in any suitable manner. The invention also consists partly of a longitudinally or spirally grooved bare or core wire, having an insulated electric wire or wires in each groove, and the whole covered with a fibrous material. It also partly consists of a longitudinally grooved bare or core wire, having an insulated electric wire or wires in each groove, and the whole covered with a fibrous material, and an exterior covering of lead. It also partly consists of a longitudinally or spirally grooved bare or core wire, having an insulated electric wire or wires in each groove, and the whole covered with any suitable insulating material.

3135. "Improvements in electric cables." W. R. Lake. (Communicated from abroad by H. A. Clark, of America.) Dated March 5. 6d. Relates to a cable for telephonic, telegraphic, and other electrical purposes generally; the object being to provide a cable in which leakage shall be prevented, and inductive effects of any wire upon the others obviated as far as possible.

3587. "Improvements in vibrating electric motors." A. L. Parcelle. Dated August 11. 8d. Consists of a spring tongue, reed or bar, or of a pivotted non-resilient bar, provided with supplementary opposing springs, and may be of any suitable or desirable material. The armature upon which the motor magnets act is located upon the end of the vibrator, and lies in a plane transverse to its longitudinal axis. The motor or vibrator magnets are arranged opposite the armature with the faces of their poles in a plane parallel or substantially parallel therewith, so that the armature vibrates across the faces of the magnets. The local circuits through the motor magnets are opened and closed by the vibrator in its movement, as is well understood.

3670. "An electric incubator and foster-mother." H. Neumann. Dated March 16. 8d. This apparatus is designed to effect the hatching of eggs and the protection of young birds by means of warmth derived from an electric current. It consists of three main parts, viz.: (1) the nest, (2) a special cover, and (3) the battery, thermo-pile, or dynamo with its supply and return wires, thermometer, and magnetic coil, forming when fixed an automatic cut-off or regulator for adjusting the temperature of the nest.

3726. "Improvements in galvanic batteries." H. H. Lake. (Communicated from abroad by J. Serson, of America.) Dated March 16. 8d. Consists in certain improvements in the construction of the outer jar, inner cell, and electrodes, whereby the inventor is enabled to charge the batteries in a way to obtain the most effective results.

4058. "Improvements in telegraphic recording instruments." A. M. Clark. (Communicated from abroad by the New Haven Clock Company, of America.) Dated March 23. 8d. Consists, first, in the employment of a cutting roller in the place of a cutting pin for marking the paper where the same is in contact with another roller; second, in providing the apparatus with a slide to which the electro-magnets, the armature, the binding post, and the electrical conductors are secured, and which slide can readily be removed from the remainder of the instrument for inspection and repair; and, finally, the invention consists in providing said sliding portion with a non-conducting plate in which the binding posts and the ends of the conductors are secured.

4072. "Improvements in telegraphic recording instruments." A. M. Clark. (Communicated from abroad by the New Haven Clock Company, of America.) Dated March 23. 8d. Relates to sundry improvements in telegraphic recording instruments which are instruments for printing or marking messages upon strips of paper, the marking instruments indenting a strip which is fed through the machine by clockwork. The first part of the present invention consists in making the indenting roller which is carried by the armature lever adjustable on said lever for the purpose of regulating the depths of the indentations produced in accordance with the size of the indenting roller, thickness of paper, or thickness of feed-roller. Secondly, the invention consists in making the feed lever, that is to say, the lever which locks and releases the clock work, in two parts of which one is adjusted to regulate the stroke of said lever. Thirdly, the invention consists in constructing a paper guide of two sliding cheek pieces fitted upon a right and left screw. Fourthly, the invention consists in a new manner of hanging the upper feed roller so that it can be adjusted by one screw; and—finally, it consists in rigidly connecting the spring of the reel shaft to the washer.

CORRESPONDENCE.

Arc and Glow Lamps.

A correspondent has been making enquiries respecting a book on incandescent lamp manufacture.

Although at present no such book has been published, the want will shortly be supplied by the appearance of the new volume of our "Specialists' Series," to be ready in about a fortnight.

The book is written by Julius Maier, Ph. D., and entitled "Arc and Glow Lamps," a practical hand-book on electric lighting.

Immediately on the appearance of the volume, a copy will be sent to your paper for notice.

Whittaker & Co.

London, *June 23rd*, 1886.

Primary Batteries.

It is evident from the frequent correspondence upon the above subject in your columns that they are once more coming to the fore; and there is no doubt that there is a very large field for a good primary battery. There are numbers of private houses in which the incandescent lamp would be an inestimable boon, and whose owners would not be critical as to whether the cost of working exceeded that of gas or not, so long as it was not excessive, and the service was good; that is to say, that they could have a good light when and where they wanted it; but where an engine and dynamo would be out of the question. The convenience and comfort of the incandescent lamp hardly require pointing out to electrical engineers; yet it may be well to mention that this extra convenience and the avoidance of smoke, heat, destruction of furniture, makes it worth more money than gas or oil as an illuminating agent.

At the same time, I think we should be most unwise to deceive ourselves with the hope that the average English domestic will ever—or at least for some years to come—accomplish the feat of attending to a primary battery, so far as we know them at present arranged for lighting, even though it be of the simplest form.

And for this reason, though we should gladly welcome a new departure such as Mr. Upward has made, in the hope that it may lead us by and by to something good; we cannot help feeling that, with our present knowledge, and with the present habits of domestic servants, and even the knowledge and habits of the present race of men who may be set to look after these batteries by the makers or contractors, he has made a step in the wrong direction. His apparatus is far too complicated; you have first your chlorine generator, then your primary battery, then your secondary battery, and connecting or attached to these various chemical and electrical appliances, designed to keep everything right, but each one being itself a possible source of failure.

I think it may be safely assumed that no domestic servant and few battery men are to be trusted to manage a chlorine generator.

Experience has shown that in order that any electrical apparatus shall be successful, when used by the general public, one of two conditions is necessary. Either the whole apparatus itself must be so simple as to require practically no attention, or a sufficient number must be used, or those used be of sufficient importance to warrant the employment of a skilled man specially to look after them. The number of electric bells in private houses, and of electric signals anywhere except on railways, was very small indeed previous to the advent of the Leclanché battery. And it will be the same with lighting batteries. We can hardly hope for them to become as simple in working as the Leclanché in its sphere for many years to come; and we shall, therefore, have to fall back upon the attendant battery man. This official may in time learn to manage the chlorine generator, and to keep all the multitude of apparatus that are attached in order. But for my own part I should prefer setting him before an honest bichromate battery, and I think the results would be more satisfactory.

And now as to the chlorine gas battery itself, and the advantages claimed for it. I note that while in *Engineering* it is stated that the zinc stands in a solution of chloride of zinc, in your correspondent's description plain water only is mentioned. Probably what takes place is, the inner cell is filled with plain water, but the battery does not begin to furnish much current until the water has penetrated to the carbon on the one hand, so as to form a liquid passage for the current, and, on the other, until the solution surrounding the zinc is more or less impregnated with chloride of zinc.

The action I take to be as follows: zinc combines with the oxygen of the water, and possibly with some of the chlorine, while hydrogen is set free in the carbon cell, combining there with the chlorine gas to form H Cl.

If this is so it is sheer nonsense to talk of no depolariser being employed; and, as every electrician knows, the depolariser is not a source of power, but a remover of a source of weakness.

Again, it is stated that the very commonest zinc may be used, that it requires no amalgamation, and no attention, as there is absolutely no local action. I should like to ask here what happens if there happens to be a small piece of iron cast in the zinc; or if, as almost invariably happens with cast zinc, different portions of the rod are in different conditions, will you leave any the less formations of those minute batteries which we know as local action, though no acids are employed? They may not be so active because the resistance of the connecting liquid is comparatively high; but this is against the battery itself. I think, too, that in practice the beautiful freedom from attendance which the inventor expects would hardly be realised, and it is worth noting that in order to get rid of the necessity of putting acids in the battery—an operation which any battery man can perform, and with which he is perfectly familiar—the chlorine generator is added, necessitating itself the addition of acid and the washing out and manipulating of apparatus that he probably never saw before, and that he has an uneasy feeling that it will blow up if he is not careful. The results given by M. Hospitalier of the tests of Mr. Schanschieff's battery are certainly very good, but they have been exceeded by a bichromate battery invented by Mr. Maquay, which I had the pleasure of testing some months back in London.

Mr. Schanschieff's battery besides has apparently two grave faults. Its E.M.F. is low, and the cost of solution is enormous. Even after allowing for the returned liquid at Mr. Schanschieff's own figures, and taking his own method of calculation, the cost for solution is very much in excess of that of Maquay's battery, as the figures given below will show.

I think, too, that Mr. Schanschieff has omitted the cost of collection of his spent liquids, which might be a serious item. The same causes which would prevent the British "slavey" from attending properly to a battery, would also militate rather seriously against the collection of spent liquids; and it is doubtful if even the battery man could be trusted to do this, in every case. It would be so much less trouble to throw it down the sink.

I think it will be wiser in our calculations not to depend upon the recovery of spent liquids for the present. Refresh them as much as possible, and when all has been done in that direction throw them away, and charge afresh.

The following figures, which are taken from a report made by me on the Maquay battery in December last, will probably be interesting. As I told the gentlemen who employed me, and I think most of your readers will agree with me, the results obtained far exceeded in many points anything that had previously been done, or that was thought possible, with primary batteries.

The battery tested consisted of six small cells contained in a cubical box measuring 3½ inches in the side, and weighing complete, when charged, 7 lbs.

It was connected in circuit with an incandescent lamp, and a very sensitive ammeter, reading to ·025 ampère.

It furnished a current of 1 ampère at 11½ volts. The readings were as follows :—

	Ampère.
At the start	1·0
2 hours after	1·0
2½ " "	1·0
3 " "	0·995, just under the 1 amp.
3½ " "	0·975
4 " "	0·960
4½ " "	0·950
5 " "	0·900
5½ " "	0·85
6 " "	0·825
following very slowly till	
7 hours after	0·525

I had no voltmeter by me sufficiently sensitive to follow the fall of E.M.F., but it will be seen from the above that it must have been small, as the resistance of the incandescent lamp would rise as the current fell.

I, however, tested another battery containing 18 cells similar to those in the small battery. These were also connected to an incandescent lamp, and the E.M.F. tested from time to time. In four hours it only fell from 32·5 volts to 32·25 volts.

Since then I have had the opportunity of testing the working cost, in the workshop belonging to my firm, and I make it for solution alone, which is, I think, all that Mr. Sehanschieff has reckoned, and summing up the number of watt-hours furnished in the same manner that he has done, only 0·02d. per watt-hour as against 0·323d. per watt-hour with Mr. Schanschieff's battery.

Mr. Maquay has also worked out in connection with his battery, a system by which the zinc becomes thoroughly amalgamated all through, and will therefore wear as long as it will hold together, without reamalgamating.

Sydney F. Walker.

Cardiff, *June 22nd*, 1886.

Telephone Transmitters.

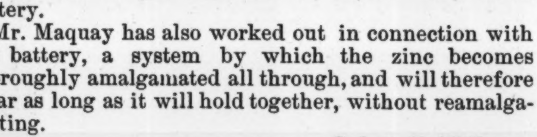
Would any of your correspondents kindly oblige by saying what a telephone transmitter should *not* be in order to avoid infringing the patent rights of the United Telephone Company? I know carbon is not allowed; but what are their other claims?

W. Holder.

Newport, Mon., *June 22nd*, 1886.

Inter-Communications in Trains.

In your issue of May 21st, there was an article on this subject by Mr. Paul; don't you think it would be almost as simple to have an arrangement such as shown in the accompanying diagram? The



current is broken between the wires, B and C, and is established by pressing one of the pushes, *a*. With this arrangement the ordinary bell can be used; instead of the wire, D, the rails or couplings, might be used.

I don't think it would be necessary to have a break-away signal in trains where the vacuum brake is used.

J. D. Leach.

31, Clifton Road, Aston, Birmingham.

[It is not at all obvious why our correspondent should suggest the use of *three* wires (or two wires and the rails), as it must be clear that the ordinary arrangement of placing the battery between the points, X and Y, and connecting the contact points of the keys either to a return wire or to the rails would answer just as well. Of course it would not be necessary to have a break-away signal in trains fitted with vacuum brakes, but the signalling arrangement of Mr. Paul is obviously meant for cases where such brakes are not fitted to the trains; in such cases the suggestion of our correspondent would be useless.—EDS. ELEC. REV.]

A New Type of Dynamo.

In your last issue, when describing and illustrating the new Goolden and Trotter dynamo, you say: "A very similar pattern has recently been produced by Mr. Kapp." Your expression "*recently*" is, however, somewhat misleading, because with the rapid progress going on all around us one is hardly justified in describing a thing as recent which is more than a few weeks old. Now by referring to my books I find that the date of design and working drawings for the first single horseshoe machine falls into the period from July 24th to July 27th of last year, and that this machine was tested on August 28th of last year.

Moreover, the type of field which you call a recent production was described and illustrated last November in a paper I read at the Institution of Civil Engineers, and at that time several large dynamos of this pattern had already been made by Messrs. W. H. Allen & Co. to the order of the Admiralty.

Gisbert Kapp.

Wimbledon, *June 21st*, 1886.

Trembling Bells.

We observe in a recent issue of your journal an abstract of patent specification No. 7,373, 1885, relating to improvements in electric vibrating bells. The inventor, Mr. W. R. Wynne, claims the provision of a contact lever, separate from the armature, and provided with projections which engage with a projection on the armature. The whole is designed that circuit may not be broken until the armature has nearly completed its movement towards the magnet; and that it may be established with similar delay. We shall be obliged if you will permit us to state, through your columns, that the principle of this invention was known to us at least two years ago; and that in 1884 Mr. Wynne's application of it was embodied in the construction of electric bells, and an electric pen still in our possession.

We may add, that in the case of most bells, the improvement is of little value, owing to the like resulting effects of self induction.

T. S. & W. Taylor.

Leicester, *June 21st*, 1886.

Dynamo Engines.

In an editorial appearing in your issue of June 11th, bearing the above title some comparisons were made between the economy of the Westinghouse and other engines that, to say the least, were decidedly unfair.

How, or by what means, the data given were obtained, it is impossible for us even to guess, as no trials were made by us that gave such results, and no statements were published containing them. It is, of course, possible that the managers of the ELECTRICAL REVIEW have disinterestedly carried on a series of trials that would benefit only the makers and buyers of high-speed engines, notably some of the former, but if this is the case why not mention it with full particulars? Failing this we can only assume that the figures given of the Westinghouse engine's performance were mere guesswork.

We would ask, does a comparison of a simple engine of one type with a compound engine of another type, to the disadvantage of the former, appear to you as being in any way fair? Do you believe that a comparison of fuel burned comes within the bounds of common sense, when both are estimated from an alleged water consumption, and in one case the coal is supposed to evaporate 6½ lbs., and in the other 9 lbs. of water per pound of coal. The question of consumption of steam (not coal, that involving the economy of the boiler) in high-speed engines is an important one to the great mass of engine buyers and owners, as the tendency of the age is in the direction of faster speeded motors than are at present in general use, and it cannot be settled in a satisfactory manner by special trials, under special conditions, by special men who have special interests at stake.

There is, in fact, but one way to settle this matter for the present time, for in all cases the progress of the age makes any decision but temporary in its character, and that is in the appointment of a committee of disinterested experts by one of the leading scientific societies to investigate the subject and publicly report the results, as suggested by our Mr. Alley in the discussion of Mr. Imray's interesting paper on high-speed motors, read before the Institution of Civil Engineers at their November meeting, in 1885, in which he says:—"In connection with Mr. Imray's paper on high-speed motors, it would be most interesting to find out the exact consumption of steam per brake H.P. by practical tests conducted by a committee of experts in no way connected with, or interested in, the manufacture of high-speed motors. To carry out an investigation of this nature Messrs. Alley and Maclellan would be glad to supply a Westinghouse engine, and, if necessary, pay a portion of the cost of such experiments. He had no doubt that other makers of good high-speed motors would, for the sake of science, also be glad to join in the experiments to show what could be done by high-speed motors. If such data as the proposed committee would gather from these experiments were published it would determine the vexed question of the consumption of steam in high-speed motors of various types, in proportion to the actual available power given out by the crank shaft. He had no faith in power calculated from indicator diagrams in high-speed motors; these diagrams were only useful to show the points of cut-off and the expansion of the steam. A test by brake that would give the useful work was wanted, independent of statements made by inventors and manufacturers which might be considered more favourable than they deserved to be. With reliable data of this nature engineers would have more confidence in using high-speed single-acting motors."

Doubtless when that is done, the experts in charge will not compare the economy of one engine working with 95 lbs. pressure of steam with another working with 115 lbs. pressure per square inch.

In regard to other considerations of high-speed motors—and, by the way, what is high speed? How is it defined, and just at what point does an added revolution to an engine's turns per minute change its class from low or medium to high speed? You state in the article that you have a rooted antipathy to anything over 600 revolutions per minute, but for what type or size you do not mention. If you should attempt to run a 300-H.P. engine of any kind or class at this speed with the steam pressure at present in ordinary use you should find that it was an extremely high speed, and after wrecking the first engine your antipathy would root itself to a much lower maximum speed for that engine at least.

On the other hand a properly designed 3-H.P. single-acting engine would run successfully at double 600 revolutions, because it would not involve strains beyond the bounds of prudence or safety.

There are engines in use at the present time running 30 revolutions per minute, where an increase of a few turns per minute, would be ruinous to their good working. Therefore for these engines 30 revolutions should be called a high speed, for it closely approaches the limits at which they will work in a satisfactory manner, while other engines of a different design and the same or larger sizes are working smoothly and satisfactorily at double this speed, and that is not considered, nor is it, a high speed for these latter engines under the conditions they run.

Therefore, is it not plain that what is high speed for one engine, under certain conditions, may be extremely low for another, or even the same engine under different conditions. Although you do not state in the article referred to, it is implied, that the only use for high-speed motors is for direct connection to the machines to be driven. And we may remark why not find objections to these machines for their high speeds, as well as the motors that drive them. Both to work well must be designed and built in accordance with the inflexible natural laws, therefore the objections would be as well founded in one case as the other.

But to return to direct connection, why should high-speed motors be only fit for that. If the machine is to be driven at a considerable speed by belts or ropes, is it not an advantage to have a motor to drive it running at nearly the same speed and belted to it direct, dispensing with the costly countershafting and its accessories and the inevitable bills for belting, oils and repairs that this slow-speed method entails, leaving out of the question the excessive space taken up in the latter case. A higher speeded motor will be cheaper in first cost, in cost of foundations and in erection expenses, and the saving from these sources on a 50-H.P. engine is too important an item to neglect.

In regard to repairs, the writer knows of several hundred, so-called, high-speed single-acting engines in America whose average yearly cost of repairs and of losses sustained through stoppage of work on that account, is much below what is considered good records with low-speed engines.

As to the question of wear, you assume, for instance, that because one crank shaft turns twice as fast per minute as another, it will wear away, or the bearing in which it revolves will be worn away in one half the time in the former than in the latter case, regardless of all other conditions.

Investigate this a little. Is not wear in proportion to pressure as well as speed? Does not lubrication have considerable influence on the amount and character of wear? and is it not a fact that in the best class of high-speed engines, notably the Westinghouse, the thorough lubrication of the working parts has been more completely arranged for and ensured than in any other class.

Take the case of two 100-H.P. engines, one running at 100 revolutions per minute, which will be classed as slow, and the other running at 300 revolutions per minute, which would be classed by many, though they might be unable to explain why, as a high-speed engine. As they are both to do the same work it does not appear unfair to say that their shaft bearings should have the same surface, and if made so probably we should be told that as one engine ran at one-third the speed of the other, its bearings would last three times as long. Look at it another way: one engine runs three times as fast as the other, therefore, to do the same work, its cylinder capacity need only be one-third as great and the pressure on its bearings one-third as much per square inch as its slow-speed competitors. Pressure × speed equals the same in each case, and the bearings should wear the same time; this is without considering the weights that are also sustained by these bearings. Taking the increased weight of fly-wheels, shaft, and connections into account, the pressure per square inch on the slow-speed engine bearings will be much greater than in the case with the fast-speed engine; a little figuring will prove this; for instance, the efficiency of a fly-wheel is in proportion to revolutions × diameter, and supposing the fly-wheel of the slow-speed engine to be three times the diameter of the other, it would require, in order to be as efficient, to have three times the rim weight, and would probably weigh four times as much as the fly-wheel of its fast-speed competitor, putting four times the pressure on the bearings from this source.

Therefore, in order to wear the same length of time, the bearings of the slow-speed engine would have to be made considerably larger than those of the fast-speed engine we have compared it with.

Alley and Maclellan,
Per H. G. BROWN.

[In the above communication our correspondents accuse us of unfairness because we based our remarks on tests of the Westinghouse engine, published in the *American Machinist* 18 months ago. In our leader on the subject we gave the steam consumption as well as that of the fuel, and since the former does not depend on the economy of the boilers our correspondents' indignant remarks on their evaporative power are entirely lost upon us. We should be glad to give publicity to any later tests of the Westinghouse engine, and under the circumstances we think our correspondents would have done wisely in furnishing us with more recent figures. For some reason or other unknown to us they refrain from doing so, but we are favoured instead with a collection of platitudes which must be familiar to every engineer. Doubtless the tests we instanced were published for the express purpose of showing what the engine could do, and we do not see that we were guilty of any unfairness in making them known to an extended circle of readers. Once for all, let us remark that we want figures, not generalities. Give us the figures and we can do the generalising for ourselves.

It is not for experts to dictate to the makers the pressure at which their engines should be worked, nor the speed at which they should run. Presumably makers know the working conditions best suited for their engines, and it is the duty of the expert who reports simply to test them under those conditions.

Our correspondents' remarks regarding the speed of dynamos and engines are absurd, for no comparison is possible where two machines differ so essentially in character. A dynamo of given power has a limiting speed far higher than that of any engine of the same power yet designed, and makers have reduced the speeds of their dynamos simply because they could not get engines to drive them direct at the speeds of which they were capable.

As regards the working of the Westinghouse engine we beg to quote from a price list published by Messrs. Alley and Maclellan, as follows :—"It is not claimed that unusual speed is without some objection ; but we are confident that in this engine the loss due to it is reduced to such a point as to make its use highly advantageous in many circumstances. The fact that belts and shafting are dispensed with will more than compensate for loss in the engine due to high speed." From this it will be seen that our correspondents themselves admit a loss due to high speed, and from their list we learn further that 600 revolutions is the maximum speed for the smallest size of ordinary Westinghouse engine, the "special" type which runs faster being the type to which they apply the above quoted remarks. Further criticism is superfluous.—EDS. ELEC. REV.]

The Turnbull Telephone.

I was greatly surprised, and not a little amused, on reading in a New York newspaper the following :—

TURNBULL TELEPHONE IN ENGLAND.

> "Mr. Townsend Percy recently spoke on long-distance telephony in America before the Royal Institute of Telegraph Engineers in London, being introduced by Mr. W. H. Preece, chief electrician of the English Government. The following week he was entertained at Stafford House by Lord Ronald Gower, brother of the Duke of Sutherland.
>
> "Mr. Percy is introducing the Turnbull International Telephone in England."

A person by the name of W. C. Turnbull obtained a patent in the United States, February 23rd, 1886, No. 336,876, for a telephone transmitter. When it was on trial between this city and New York, over the Postal Telegraph Company's wire—made of steel covered with copper, 4 ohms resistance per mile, only one wire on each pole, it operated well—with a Morse [? Bell] receiver, as Turnbull had no patent for a receiver. I examined the instrument at that time, and published in the New York *Electrical Review* the following notice :—

ABOUT THE "TURNBULL" TELEPHONE.

> Editors *Electrical Review*,—Your *Review* of 27th inst. contains some remarks about "the distinctive features of the *Turnbull* long-distance telephone," recently tested between this city and New York over the Postal Telegraph Company's lines, and which is being introduced to the investing public by a Pole, who represents himself to be a *Count*, and who served a short time as a private in the U.S. army during the late war.
>
> Your notice of this instrument is calculated to inspire confidence in investors, and therefore I hope you will publish this my statement that the Turnbull transmitter—Patent No. 336,876, dated February 23, 1886—is clearly an infringement of the patent No. 250,308, June 8, 1881, the property of the Molecular Telephone Company, in which company I own a large number of shares. The Turnbull patent may be a valid patent, for the modifications it has of the patent 250,308, but the use of "carbon plates or bars suspended in an inclined position, and resting on carbon," constitutes the infringement. It is not surprising that the Turnbull transmitter operated well between Washington and New York—251 miles—for it is well known that the transmitter of the Molecular Telephone Company operated well between New York and Chicago—1,050 miles—in April, 1883.
>
> W. C. BARNEY.
>
> 917, Sixteenth Street, Washington,
> *March* 19*th*, 1886.

Upon examination of English patents I find that the so-called "Turnbull telephone" is identical with an instrument described in a patent—No. 2,265, May 24th—published in your REVIEW, January 28th, 1882, pape 62.

Attempts are being made here by this *Count* to organise a company to work this telephone—one of which is to-day published as being at Alexandria, a small worn-out old town some seven miles from this city.

These incorporators must have great faith that there are many fools yet willing to part with their moneys, especially in face of the recent decisions in favour of the Bell patents.

There are many rumours about this Count, who is the prime promoter of this telephone. That Mr. Preece should have taken up such an instrument, so clearly an infringement of Edison, of Bell, and of Gent and Ellery patents, surprised me.

W. C. Barney.

Washington, *June* 11*th*, 1886.

Electricity v. Heat.

I regret to note, in your issue of May 7th, that you warn Mr. James Johnstone "not to do it again"—so to speak.

I am sorry. Flashes of genius such as he seems to be subject to are really refreshing, when one is constantly delving in the dry dust of the science.

An electrical friend suggests that Mr. Johnstone is correct in his theory of a triumvirate of molecules, heat, and electricity. To use his own words :

"Johnstone makes it perfectly plain, that when a fellow picks up a wire that has a heavy current, and receives a shock, it isn't electricity that hits him, its the heat that has been attracted from the surrounding atmosphere by the current, and he isn't shocked but burned."

Seriously, Mr. Johnstone does himself an injustice. He could make millions by using his heat absorbing wires for cooling beer vaults, instead of the expensive ammonia apparatus now in use. This is a scheme for suggesting which I ask only that Mr. Johnstone shall write more, and the REVIEW publish it.

C. H. Haskins.

Wisconsin Telephone Company,
Milwaukee, *June* 4*th*, 1886.

[illegible]
"[illegible], London."

Telephone [illegible].

[illegible]

REVISED [illegible] LIST OF DYN[illegible]

[illegible] POST FREE [illegible]

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Cardew.	Electro-magnetic.
Electro-magnetic.	Ayrton & Perry.
Ayrton & Perry.	Engine Room.

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